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NINETEENTH BIENNIAL REPORT

OF THE

STATE BOARD OF HEALTH

OF

CALIFORNIA,

FOR THE

FISCAL YEARS FROM JULY 1, 1904, TO JUNE 30, 1906.



LELAND STANBROOK
UNIVERSITY

SACRAMENTO:

W. W. SHANNON, : : : : SUPERINTENDENT STATE PRINTING

1906.



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1906.

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STATE BUREAU OF VITAL STATISTICS.

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GEORGE D. LESLIE, <i>Statistician,</i>	- - - - -	Sacramento

STATE HYGIENIC LABORATORY.

ARCHIBALD R. WARD, D.V.M., <i>Director,</i>	-	University of California, Berkeley
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OFFICE OF CALIFORNIA STATE BOARD OF HEALTH,
SACRAMENTO, September 15, 1906.

To His Excellency, GEORGE C. PARDEE,
Governor of California.

DEAR SIR: In accordance with the State law, I herewith transmit to you the Nineteenth Biennial Report of the State Board of Health of California, including the report of the Bureau of Vital Statistics and of the State Hygienic Laboratory, for the fifty-sixth and fifty-seventh fiscal years.

Yours, very respectfully,

N. K. FOSTER,
Secretary of State Board of Health.

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REPORT OF STATE BOARD OF HEALTH.

The work of the State Board of Health was broadened very extensively by certain laws passed at the last regular session of the Legislature. Instead of being an "advisory board," with simply the privilege of offering suggestions, there are now defined lines of work which it is required to do. These lines relate entirely, as they should, to the gathering and arranging of vital statistics and to public health and sanitation. The Board entered upon its new duties with an enthusiasm born of the conviction that its work was, in importance, exceeded by no other department of the State government, and with a determination that California should, in the excellence and effectiveness of its health department, stand with the foremost states of the Union. How far we have succeeded, the record of our work must show.

The new Bureau of Vital Statistics has, in the short time of its existence, attained a degree of perfection which warranted the United States Census Bureau in accepting its statistics for the Census Bureau's work and in admitting California as a registration state—a distinction attained by but few of the Eastern States.

The State Hygienic Laboratory, which was created by the last Legislature, is well established and has done much excellent work for the various local health departments and physicians. Its examinations of secretions from the throats of patients have been the means of early diagnosis of diphtheria in many cases, thus averting epidemics. Work has been done also in typhoid, tuberculosis, and other contagious diseases. Examinations of water and milk have also been made, and the important subject of disinfection is being investigated.

A full report of each of these departments is appended.

The routine work of the State Board of Health and its Secretary can not be detailed in this report, but can be found in the minutes of the Board and in the reports of the Secretary rendered to it at each meeting. The Secretary has given his entire time to the work, and in answering requests for help and making investigations of unsanitary conditions has visited most parts of the State. One conference of the State and Provincial Boards of Health and one of the United State Public Health and Marine Hospital Service with the State Boards of Health have been attended in Washington, also the American International Congress on Tuberculosis in St. Louis. The conferences

during the present year were not attended, as the extra amount of work falling upon the Board on account of the catastrophe of April 18 took its time and means. This is to be regretted, as the information obtained at these conferences, composed, as they are, of the best sanitarians of the country, is of the greatest aid in perfecting our own sanitary conditions.

The office work of the Secretary has grown to large proportions. The correspondence takes a great deal of time, as there is a general awakening among the people in regard to sanitary matters. The Board has insisted that towns dispose of their sewage without endangering the health of other places or people, and the Secretary is called upon to investigate and recommend plans for doing this. The varying conditions in different parts of the State make this no easy task, and the details require a great deal of time. The Board is in constant receipt of letters of inquiry, the intelligent answering of which calls for much time and investigation. These letters, however, have all been carefully answered and filed.

For the past year we have published a Monthly Bulletin, containing matters pertaining to public health and sanitation, which is sent to all health officers, to those connected with the collection of vital statistics, to newspapers, and to others who have signified their desire for it. This bulletin has been the means of disseminating much needed information among our people.

The plans and specifications of all buildings erected by the State have been carefully examined in so far as they related to sanitary conditions, and needed suggestions and alterations were made.

The sanitary care of the State institutions has received our most careful attention, and beneficial results have been obtained.

No provision is made for any assistance for the Secretary, except such as can be secured from the appropriation of \$2,500 per year for traveling and contingent expenses. As all traveling expenses of the entire Board and its Secretary, as well as all office and contingent expenses, have to come from this fund, there is very little available for help. A clerk should be furnished the Secretary and placed on the State payroll. The State is growing rapidly, and the sanitary work even faster, and unless more help is furnished this work can not be effectively carried on.

As the law requires, we have made suggestions and recommendations as to legislative action. The appropriations asked for are all actual needs of the various institutions or departments and have been suggested only after careful investigation. Some of them are imperatively necessary at the present time, and all will have to be granted in the near future in order that the health of the inhabitants of the State may be guarded and the good condition of the State institutions maintained.

VITAL STATISTICS.

At the last regular session of the Legislature a law was enacted creating a department in the State Board of Health to be known as "a Bureau of Vital Statistics, for the complete and proper registration of births, marriages, and deaths, for legal, sanitary, and statistical purposes, which bureau shall be under the supervision of the Secretary of the State Board of Health, who shall be ex-officio State Registrar of Vital Statistics. The State Board of Health shall appoint a competent statistician to assist the State Registrar of Vital Statistics, and such clerical and professional assistance as may be required for the proper discharge of the duties of said Registrar."

The law fully set forth the work to be done, and it needed only the organization of the department to begin work. The former law relating to the collection of vital statistics had never been enforced to any extent, and but few in the State seemed to appreciate the probability of such a law being made effective.

The Board secured the services of George D. Leslie of the United States Census Bureau, and to his marked ability and knowledge much of the success of the department is due. As the collection of these statistics imposes duties on a vast number of people—doctors, clergymen, undertakers, county and town officials—a great deal of correspondence and work was necessary.

The law took effect May 18, 1905, but owing to a delay in getting blanks, the bureau was not in active operation until a month later. Since that time, however, it has gone steadily forward, not without some friction, but with steadily increasing accuracy, so that now a large percentage of all deaths are reported, as are also marriages. It is much more difficult to get births reported. Much of the objection to this work is, however, being overcome, and this important work is steadily gaining in efficiency.

All deaths, births, and marriages reported to this office have been, as the law requires, properly and completely indexed, and the certificates bound, so that reference can be made quickly to each one on record. This has required the writing of from 7,000 to 8,000 cards each month—a work of no small proportions. The State has been divided into districts and the causes of death have been tabulated in each district, so that it is possible to tell where certain diseases prevail, which will be of value as soon as the data have been carried far enough to reason from cause to effect. Marriages and births have also been properly tabulated and arranged. These tabulations and deductions are made a part of this report. All this has required a great deal of work, and the present force in the office is altogether insufficient. The law requires the Board to appoint sufficient assistants to the Secretary, but the appropriations will not warrant it, and much work that we would

like to have done has, of necessity, been passed. The value of an index is in its accuracy, and the careful making out and filing of 8,000 cards a month, together with making out certified copies which the law requires, is more than one person can do. This is by no means all the work. The correspondence of the department has grown to large proportions. Every day letters are coming from parties interested in these vital statistics, and their answer calls for much careful work and study. At the present time the statistician has no clerk, and must get along with only such aid as can be accorded him from the Secretary's office, which is itself overcrowded with work. It is imperatively necessary that a clerk be assigned to this department, for it would be a great misfortune to the State if the collection of these statistics should be in any way curtailed. They are considered everywhere of the utmost importance, and the United States Census Bureau, considering ours to have reached a proper degree of perfection, has placed the State on its list of registration states, accepting our statistics for its work. Should we fall back, this honor will be taken from us, and California can not afford to go backward.

The advantages of having the original certificates of deaths, births, and marriages on file at the State Capitol were strongly emphasized by the fire at San Francisco, where all records were lost, leaving those at the State Capitol the only ones in existence. This is liable to occur at any time and in any place. Every birth, marriage, and death should be a matter of record in the State Capitol, and stored in fire-proof vaults, for no more important records exist than these.

SANITARY WORK.

During the past biennial term the State Board of Health has been active in awakening an interest in sanitary matters and in seeing that the State laws relating thereto are enforced. As a result there has been a great demand upon the Board for aid and information. Requests are received from all parts of the State asking that a representative of the Board visit them and solve some sanitary problem. These have generally to do with the destruction of sewage; sometimes they are prompted by a demand from the Board that the pollution of some stream or lake must cease; but often the step is taken as the result of a general feeling, now on the increase, that no one has a right to poison his neighbor's water supply. As far as possible these calls have been answered by a member of the Board going in person to investigate and advise. The result has been that much sewage and waste matter which formerly flowed into streams, thereby polluting them and spreading disease, especially typhoid fever, are now destroyed.

Water, which enters so largely into the composition of the human body and is therefore necessary to the comfort as well as the existence of

life, should in all cases be pure. This, however, is not the fact, and many of the sources of supply of cities and towns, as well as of private houses, are bad in the extreme. The sewage of cities of considerable size is even allowed to run into the water supply of some neighboring city, while they in turn drink the diluted sewage of cities above. Probably the greatest danger from this method of sewage disposal is in the pollution of the smaller streams that supply the foothill towns. The Board, in so far as its means will allow, has inspected the various watersheds, and has succeeded in preventing much pollution of ice and water used for domestic purposes and in removing many nuisances. The proper destruction of sewage, thereby safeguarding the purity of our water supplies, is a subject that requires the constant and careful supervision of the Board. There is no part of the work that is of more importance, and none that in some places arouses so much antagonism. The streams are looked upon by some as natural sewers and the proper repositories for dead animals and garbage, and such persons consider their personal or municipal rights infringed upon when efforts are made to keep these streams clean. An epidemic of typhoid fever in the community, traced to such pollution of the water supply above, generally convinces all such that the other man or town is doing wrong, and it is then easy to bring home to them the fact of their own wrongdoing.

During the past two years several towns have installed septic tanks for the destruction of sewage, and generally with very satisfactory results. Some of the State institutions have also adopted this means of destroying sewage, and we earnestly recommend it in such others as have conditions favorable to it.

INSPECTION OF SUMMER RESORTS.

Complaints that come into the office of the Secretary of the State Board of Health of the unsanitary condition of some of the many summer resorts, together with the fact that many persons returning therefrom have almost immediately been taken down with typhoid fever, have demonstrated the need of the inspection of such places. The large number of summer resorts in California, and the vastness of the territory over which they extend, make it impossible for the Board, with its limited force, to inspect more than a small percentage of such places. The work has been confined chiefly to those of which complaint was made and of others in their vicinity.

As a general rule, the resorts are in good sanitary condition; but there are enough that are bad, and very bad, to cast a shadow in the public mind on all. This, of course, is unjust and should not exist, for the outdoor life that is part of a vacation spent in the mountains or at

the seaside is of the utmost value to those who can experience it, and everything possible should be done to encourage such outdoor life.

The visits made by a representative of the Board have resulted in much good, for in no case was there shown anything but willingness to correct all faults and improve the sanitary conditions to the fullest extent. A general inspection should, however, be made, and we have no doubt that much sickness would be avoided and many lives saved by such a move.

The greatest danger is from transient campers outside the organized camps or resorts. They establish a camp for a night or a longer time upon any convenient stream, which they use for all purposes—for bathing, washing clothes, allowing stock to stand in it, as a depository for camp rubbish, and as a sewer. As a result, those below, either permanent inhabitants, other campers, or those stopping at organized resorts, have to use polluted water, and in this way much of the typhoid fever is taken.

A vacation spent in traveling through the State, camping at night and living in the open, is both delightful and healthful, and should be encouraged, but at the same time the campers, as well as others, should be guarded from the dangers that beset them. Camping on streams which supply towns with water should be prohibited within a certain distance of the intake. This would not materially lessen the opportunities for camping, but it would be a great protection to towns.

Authority is already vested in the State Board of Health to guard the purity of domestic water supplies, but the means of doing it are not in its hands. In a State with the dimensions of California, it is impossible to properly guard, with the present force, the sanitary conditions that come under the State Board's jurisdiction. A law should be enacted making the county health officer practically a deputy of the State office, and accountable to it. This would give the State Board fifty-seven deputies, who could be easily reached by mail or wire. Complaints could be quickly attended to, and, where necessary, notices posted on all streams directing what care should be taken by campers so that no danger would result from their acts.

CONTAGIOUS AND INFECTIOUS DISEASES.

While there has been, perhaps, the usual amount of contagious diseases in the State, there has been no extensive or particularly fatal epidemic.

Smallpox has been unusually prevalent, and was much more serious than in recent years, the percentage of deaths in some localities approaching what it was in pre-vaccination times. However, by active measures on the part of the local health departments, the disease has

been checked before it had spread far. In some cases the disease was wrongly diagnosed and many exposures occurred before the mistake was discovered. Most of those exposed sought vaccination at once, and escaped either altogether or with a very much modified form of the disease. A few refused to be vaccinated, and enjoyed the experience of the disease in its full force.

Vaccination, the only known preventive of smallpox, has been neglected for several years in some parts of the State, and there has come upon the stage a generation, too many of whom are unvaccinated. This neglect has caused the death of many innocent victims and the unsightly marking of many more. It is strange that in this enlightened age, when almost all physicians, and especially those who have had great experience with smallpox and vaccination, are so pronounced in favor of vaccination, there should be a few who so bitterly oppose it. They are in a hopelessly small minority, but by organization and by constantly keeping before the people the supposed danger and the idea that their rights are being trampled upon, they keep many from being properly protected.

In most cases where the disease became prevalent, all willingly sought the protection of vaccination, and we have reason to hope that this awakening will be beneficial.

Typhoid fever has claimed its usual number of victims, especially in the foothill and mountainous parts of the State. This condition will continue so long as the mountain streams, the great source of water supply for these sections, are used to receive the drainage of the habitations along their banks. While water is not the only source of typhoid fever, it is in these sections the principal one, and in several cases there has been no trouble in suppressing the disease by providing a pure supply of water.

Flies as a means of its spread should not be forgotten, for if allowed upon the dejecta of a patient, they will carry the germs to any one within their reach, and several outbreaks have been traced to them. It is not too much to hope that the time will come when house flies will not be tolerated. They are a danger as well as a nuisance, and can be practically exterminated by preventing their breeding.

Diphtheria has lost much of its terrors since the use of antitoxin in its treatment, and the death-rate has materially decreased. If this remedy were in the hands of all physicians and used early there would be practically no deaths from this disease. Several of the Eastern States furnish antitoxin free to indigents, with the result that the death-rate is far below what it is in California. There is no doubt that the cost of the remedy has limited its use.

Plague.—One case of plague has occurred during the biennial term. The patient lived in fair sanitary conditions and worked steadily in a door and sash factory. Four days before the attack he was hunting squirrels in a section where they had been dying from some epizootic. No plague rats could be found, and as there was no other probable source of infection, the conclusion seemed reasonable that it was contracted from the squirrels. The patient, while severely sick, recovered. An effort has been made to have the United States Government, through the Public Health Department, investigate the disease among the squirrels, but thus far without success. They have died extensively in some parts of the State, and the farmers are thereby relieved of a great curse. If the disease attacking the squirrels is harmless to man it should be spread, but if in reality it is the plague, that fact should be made known, so that proper steps can be taken to protect the people.

Scarlet fever, measles, and whooping-cough have occurred in their usual amount, and we will have them with us until such time as all cases are properly reported, isolated, and disinfected. In the past this has not been done; many cases, being light, have had no physicians in attendance, and hence are never reported, nor proper precautions taken. Sometimes when a physician is in attendance, he yields to the pleadings of relatives, who, because the case is "light," do not wish to isolate the patient, and frequently allow the child to associate with others long before it is free from contagion. These diseases are by no means a necessary part of one's existence, and as many deaths result from them, particular care should be exercised to keep children from exposure. This will never be possible until there is a law enacted requiring all contagious, infectious, and communicable diseases to be reported to the health officer by the physician, if one is in attendance, otherwise by the parents or guardian, and a severe penalty for its disobedience. Such a law we heartily recommend.

TUBERCULOSIS.

More deadly than any other disease, tuberculosis easily leads the list of causes of death, one in every seven deaths resulting from it. As this is a preventable disease, such a death-rate is not flattering to the State and calls for active work on the part of all classes of society and branches of government. The death of over 4,000 per year from one disease, and that a preventable one, should alarm every one. If diphtheria, cholera, scarlet fever, or any of the actively contagious diseases should kill one quarter this number there would be such consternation that people would leave the State. The fact that one in every seven of us is doomed to die of this disease does not, however, seem to cause concern, except among the very few who interest themselves in the wel-

fare of the human race. The old feeling that tuberculosis is unavoidable has not fully passed away and its slow invasion makes it seem less dreadful. The high death-rate in California is not normal to the State, but is the result of so many coming here from other states, seeking the advantages of our climate, but seeking it too late, and dying during the first few weeks of their residence here.

Consumption should be a rare disease in California, and if people were properly instructed as to means of prevention, and these means provided for them where they can not secure them themselves, it would be. Very much can be done by education, and therefore such means of enlightening our people on the contagiousness of this disease should be pushed to its utmost; but it avails little to teach parents that good food, rest, and country air will restore their child to health when the means of the family will provide only a miserable living in a more miserable tenement. The State has a duty here in passing laws that shall require tenements to be built so that all rooms will receive air and sunshine, and that workshops and factories shall be kept in a sanitary condition; and each city and county should provide sanatoria for those who can not be properly treated at home.

We would strongly advise that an appropriation be made for the purpose of publishing and distributing educational matter relating to the prevention and management of this and other communicable diseases. Also, that a law be passed prohibiting expectoration in public buildings and in public conveyances.

PURE FOOD.

At last a pure-food bill has passed the United States Congress and become a law—a long-needed step in the right direction. Congress can, however, deal only with interstate traffic. The law will give us some relief in the prevention of shipments of impure and adulterated foods and drugs from other states, but none from unscrupulous manufacturers at home. That much suffering is caused and many deaths result from impure and adulterated food, no one who has studied the conditions will for a moment doubt. Most of our long list of deaths from enteric troubles are the result of impure food, and to stop the deaths the cause must be removed. This the State can do, and if she wishes to keep in the van of progress, she must take steps to prevent the wholesale slaughter of her inhabitants. The slaughter of these thousands by adulterated food is, to all intents and purposes, as much murder as though they had been killed by the more active poisons, as strychnine or arsenic, and the perpetrators should be dealt with accordingly.

Our State Legislature should enact a law as nearly as possible along the lines of the United States law, prohibiting the manufacture, sale, or

shipment of impure or adulterated food and drugs, and also insuring their being properly labeled. Our character as a State depends in no small degree upon the honesty of the manufacturer, and one shipment of impure or falsely labeled goods will do us more harm than any number of pure ones can counteract. We should have the same interest in protecting the health of the person who is so unfortunate as not to live in California, as we would have were he one of us. We earnestly recommend a safe and strong pure-food law, with the necessary appropriation and authority to enforce it.

RIVER OVERFLOW.

It may seem a long step from river overflow to sanitation, but a moment's consideration will show that it is a subject pertinent to the State Board of Health. Each winter and spring thousands of acres are flooded with water teeming with vegetable and animal life. This water, as the river falls, is confined behind the levees, and under the influence of the hot sun soon becomes stagnant and putrid from decaying matter. The odors arising from this are terrific, and this Board is sometimes called upon for relief. That these complaints are just, a short sojourn in the neighborhood will prove; but it is impossible for the Board, or any one else, to give the desired aid, for there are no means in our power either to remove the water or to purify it. It is contended that odors do not cause disease, but such intense ones as are here produced will at least lower the resistance of the body by destroying nutrition. Appetite is destroyed, as is often the power to retain food that is eaten. At night the odors are so bad that the windows and doors of houses must be closed, people preferring the close, stifling air of a heated house rather than smell the intense odors coming from the overflow. This, for those used to sleeping in the open air, can not be otherwise than detrimental. Looking at it from a sanitary as well as from a financial standpoint, a broad and statesmanlike policy of reclamation and river improvement should be adopted. Otherwise the inhabitants living on the borders of these large tracts of overflowed lands will, owing to a lowered vitality, be more subject to disease, if indeed they are not entirely driven from their homes.

SANITARY ASSOCIATIONS.

Believing that in the battle with unsanitary conditions, organization is of as much importance as in any other contest, the State Board of Health began the formation of sanitary associations. The advantages of these will be recognized by any one who has had occasion to observe the indifference with which many of the most important steps for the prevention of disease are carried out. Isolation, disinfection, vaccina-

tion, prevention of the pollution of water supplies, the care and destruction of sewage, and the numerous other questions which come before a health officer are as sealed books to some of them. They are subjects that were not taught them in school, and their attention has never been given actively to the consideration thereof. By associating with the more active, earnest officers and by listening to the papers and taking part in the discussions, the less informed officers grasp the necessity for further knowledge and oftentimes make excellent officials.

The first association formed was the California Public Health Association, which has held semi-annual meetings for three years. These have been full of interest, with many excellent papers and discussions. The greatest difficulty met with is to get the health officers in the more remote parts of the State to attend. This is not entirely from want of interest, although some health officers, like some others in official position, seek to get the honors and emoluments of their office with the minimum amount of labor. Most of them are busy practitioners and get but small pay for their services as health officer, and consequently can not afford the expense of a long journey to attend the meetings. To obviate this in a measure, the Board invited the health officers of the San Joaquin Valley counties to meet at Fresno during the last summer, and organized the Central California Health Officers' Association, and it is intended to organize others in the near future. This will bring them together more, but still many will not attend.

The absence of any of our health officers from these meetings is a distinct loss to the communities which they represent, for the subjects discussed are all pertinent and apply to every county and town in the State. The people would be the gainers if their health officers could attend and acquire knowledge which would be used in their several jurisdictions. In some of the Eastern States these associations are part of the State health organization, the same as teachers' institutes are part of the school system. This brings together each year all the health officers of the State, so that instruction can be given them, topics of general interest discussed, uniformity of action assured, and mutual assistance rendered.

We recommend that a law be enacted requiring each county and municipality to send a delegate from its health board to the meetings of the State association, his necessary expenses to be paid from the county or city treasury.

EXAMINATION OF SCHOOL CHILDREN.

There is no doubt that many children fail in school and in life because of a remediable defect in some organ or organs. That these defects should be allowed to go uncured or untreated and the children

become dependents on society does not speak well for the judgment of the State, but such is the fact in most parts of California as well as elsewhere. A start has been made, however, and we may soon expect to see every child in our schools regularly examined, not only for defects in sight and hearing, but also for others that may be equally as bad. The examinations should go further than to discover organic defects. The examiner should be expected to watch the general condition of the children and to judge as to their physical ability to continue a certain course of study. This should be done by the municipalities. The State is helping to educate several thousand orphans, and to these it owes the same care that the municipality should give its children. Indeed, the need is greater, for the circumstances under which these wards of the State have been reared are less fortunate. Arrangements should be made whereby each one of these unfortunate children could be carefully examined, and when found to be in a condition needing treatment such treatment should be furnished.

The following article by A. J. Pillsbury, Secretary of the State Board of Examiners, relating to these wards of the State, meets our hearty approval, and we respectfully recommend the enactment of effective laws carrying a sufficient appropriation for this purpose:

HELP FOR THE HANDICAPPED.

What farmer, if he have a scrawny, wobbly pig delivered with a litter, will not straightway take that pig to the house, fix up a nursing bottle for it and so attend to its health that it will soon be able to take its place with its fellows at the maternal repast and in the trough, squealing and struggling as lustily as its brothers and sisters? What chicken grower, if he find a weakling hatched out with a lusty brood, will not coddle the weakling against a warm brick behind the kitchen stove until it gains strength to struggle for its own existence with its downy companions?

I want the juvenile wards of the State of California as well looked after as though they were so many candidates for pork barrel and gridiron, and for a not very dissimilar reason: It pays.

In the main, with here and there a notable exception, the dependent classes are recruited from the ranks of the handicapped. These are they who fill the hospitals for the insane, the prisons and reformatories, the homes for feeble-minded and, in a very considerable number, the orphanages.

The young men, of college age, confined in Elmira Reformatory, New York, average in stature about the same as young women in a female seminary, or four inches shorter than college men of the same age. There have been instances where nature has packed fine, strong minds into craniums supported by small and badly nourished bodies, but these were nature's freaks and not her normal and usual product. As a blunt fact, the dwellers below the prosperity line are dwarfed in body and mind, defective in one or more organs and deficient in vitality.

I do not make these statements in aid and comfort of those devotees of the doctrine of heredity who are often as desirous of laying their own shortcomings at the doors of their ancestry as they are of holding the horrors of hereditary tendency up before the bleary eyes of their bibulous neighbors, the better to convict them of sin. There is a deal of truth in the doctrine of hereditary tendency, vital, appalling truth, but the mischief wrought by it is, in many if not in most cases, susceptible of being remedied by timely treatment and painstaking nurture.

Prof. George R. Leslie, Director of the Science Department of the city schools in Los

Angeles, has undertaken to make a physical examination of all applicants for entrance into the public schools of that city, and his investigations, so far as they have gone, show that twenty-five per cent of all applicants are physically defective in hurtful degrees—in degrees that, unless remedied, will handicap such children throughout their lives.

I have no doubt that the percentages of deficiencies among the State's orphanage wards will rank much higher. The public school children of Los Angeles come in the main from families whose standards of living are above the poverty line. The orphanage children all come from families below the poverty line, else they would not, or should not, be in an orphanage. They are the handicapped product of a handicapped parentage, and therefore doubly demand all that science and nurture can do for them.

What chance has a child to develop into a healthful and helpful citizen if a near-sightedness be permitted to contract its distinct vision to within a range of twenty inches, beyond which distance all things are seen as they are not instead of as they are? What chance has such a child for the forming of correct judgments and for seeing life as it is?

What chance has a child whose defective hearing makes it miss half that is said and heard by others, half that goes on in recitation and on the playground—the most valuable recitation room of all?

What chance has a child for developing a virile constitution when adenoid growths in its throat shut out half the breath from the lungs, leaving the blood scantily aerated, the chest half expanded?

What chance has a child for normal development when its teeth are permitted to so rot that it becomes as nearly toothless at fourteen as it should be at forty-five, when every mouthful of food sent to the stomach is tainted with the poison of decay, and when every breath inhaled is as heavily laden with putridity as every breath breathed into the faces of his nauseated companions?

What chance has a child for developing a self-confident and courageous character when its bandy legs and knock knees make it the laughing stock of the playground, when its teeth are allowed to grow out like tusks, disfiguring the countenance, when the child has no strength with which to measure its playmates, no endurance to bear a robust part in their games, and when it has nerves which people dark corners with spooks and dark nights with goblins?

Fortunately for handicapped childhood, physical deficiencies are often if not generally remediable, if taken in time. The New York Foundling Hospital (Catholic) has gone at this work with a degree of enthusiasm and intelligence that is positively inspiring. Every child that comes into its custody is submitted to a rigid examination, and, if such examination develops the fact of remediable deficiency, those deficiencies are treated with the highest skill the great metropolis affords. Some of the most proficient surgeons in the city volunteer their services, bandy and bow legs are broken and set straight, tonsils removed, paralyzed nerves sutured, and all things done that science knows how to do to relieve the war-torn State of handicaps under which, otherwise, they must run their respective races for life in competition with other persons who are weighted down with no such burdens.

In many of the states east of the Rocky Mountains juvenile wards of the State are looked out for efficiently in this regard. In Iowa, members of the faculty of the medical department of the State university visit institutions, at the cost of their expenses only, for the purpose of making examinations, and hospital cases are taken to the university hospital for treatment. Michigan follows a similar policy, and the Massachusetts general hospital receives numberless cases coming under this classification.

I do not doubt that as many as one third of the more than five thousand dependent children in the orphanages of California are handicapped by physical deficiencies in one form or another, the greater part of which might be remedied by proper treatment, either surgical, medical or hygienic, and, if we include bad teeth, I think that the percentage of defectives will total one half.

The teeth of children are greatly neglected, not only in institutions, but in family life, and to the serious detriment of the children. Nature, in healthy children, absorbs the milk teeth from within the gum without decay, but if a child have a low vitality teeth decay from without. Decay is always poisonous, and a mouth full of rotten teeth

means malnutrition, malnutrition means a badly nourished brain, and a badly nourished brain means either a delinquent or a backward child, and generally a child that is both morally delinquent and intellectually backward.

As if physical deficiencies were not a sufficient handicap, it is a fact of common experience that the consciousness of inferiority, physical or intellectual, weighs down the spirits and gives rise to a morbidity of mind that is even more grievous to be borne than the handicaps themselves. Such a consciousness discounts enterprise, fosters the habit of brooding, turns the channels of thinking inward instead of outward, develops a mind full of all unhealthfulness, resulting in inefficient if not bad citizenship, and not infrequently in insanity.

To the credit of our orphanages be it said that they all have more or less of medical attendance and supervision, but, notwithstanding this fact, they are lacking in such a close and systematic medical attention as their wards require. If a child is sick a physician is summoned, and if a tooth aches it is pulled, but there is no such keen scrutiny into physical conditions as the situation demands.

The fact is that the ordinary medical practitioner does not rise to the full requirements demanded. No one less observing than a trained specialist in childish deficiencies will detect, or realize, the importance of deficiencies that are really serious, if not to life, at any rate to efficient living.

In my judgment the State of California should employ one or more experts in children's diseases, preferably a man and a woman, to devote themselves to the juvenile wards of the State in orphanages and in industrial schools. Each child should be stripped to the buff and examined in every particular, deficiencies diagnosed and treatment prescribed. Attention should also be given to sanitary conditions and to diet, to physical training and mental discipline in special cases.

To make this work effective it may be necessary to establish a small children's hospital in connection with the medical department of the State University, or else make proper arrangements for treating hospital cases at public expense in reputable institutions throughout the State.

The general service herein outlined might properly be performed under the guidance of the State Board of Health, or if there be fear of unwholesome political influences being brought to bear upon the work through that instrumentality, then let the service be required of the medical department of the State University. Whoever is made agent of the commonwealth for the performance of this function should be endowed with ample powers, not only for ascertaining what should be done, but also for doing the needful thing when it has been ascertained. Personally, I do not fear the prostitution of the office to political influence if confided to the State Board of Health, but the medical department of the State University would perhaps give greater promise of permanency and a continuing service.

I favor the State of California entering upon the service herein outlined, because it will pay the State to do it. There are humanitarian considerations which do, in fact, outweigh all other considerations, but the State will pay, at once and roundly, is more likely to appeal to the practical man. Criminality is enormously costly, and pauperism and insanity only less so, and it can not be denied that the ranks of criminality, pauperism, and insanity are mainly recruited from among those who are handicapped from birth by physical deficiencies and abnormalities, many if not most of which are, in the light of modern science and nursing, clearly remediable.

Furthermore, the State is the ultimate guardian of all of its wards, and it should either assert its power and authority more abundantly or abandon it altogether. A divided responsibility is always productive of inefficiency. The orphanage people throughout the State will be found ready to cooperate heartily and not unintelligently, but inasmuch as the State now pays only about three fifths of the cost of taking care of dependent children these institutions can not well be required to do more than they are now doing. This consists mainly in housing, feeding, and clothing their charges and imparting to them such lessons in industry, culture, and religious instruction as they are able to receive in their present physical and mental condition.

If the services outlined above shall come to be performed for the institutional wards of the State it will prove an object lesson of such incalculable value to childhood in

general that it will be no long time before all public school children will be given as good advantages in this respect as the State shall see fit to give to the children of the impoverished and the negligent. An aroused public conscience will not rest satisfied until, in California, everybody's children are as well cared for as nobody's children are cared for in that great institution in New York devoted to the care of the nameless product of unrestrained licentiousness.

A. J. PILLSBURY,

Secretary of State Board of Examiners.

SANITARY INSPECTION OF STATE BUILDINGS AND INSTITUTIONS.

The law requires that the State Board of Health shall have sanitary control of all buildings or places owned, leased, or controlled by the State, and that all plans and specifications, in so far as they relate to sanitary matters, must be approved by it. This has given the Board much extra work, there being no provision for an expert engineer to do these duties. The Board has, however, done the work to the best of its ability, and has been able to make suggestions whereby the sanitary condition of new buildings has been improved.

This is one of the most important duties of the State Board of Health, for besides the danger of unsanitary conditions in new buildings, there is annually a large expenditure for remodeling. There should be attached to the Board an expert sanitary engineer. We have two score of public institutions, and there is constant demand for more, and especially to increase the extent of those already in existence. Money would each year be saved the State were such an officer attached to the State Board of Health. It is impossible for a person not an expert to properly inspect plans and decide on their merits, and after this is once done, under the present system, the duty of seeing that the plans are carried out devolves on the architect. He is undoubtedly honest, but is sometimes long absent from the work, and experience has shown that the State has often suffered thereby. Reconstruction work is often done by the institution from its contingent funds, and the expense of getting some one to supervise the work is quite large. This could be saved by provision being made for such an officer as above recommended, and the saving would no doubt be equal to his salary. Besides this, there is a vast amount of service he would be able to render the smaller cities and towns which are seeking to improve their sanitary conditions but have no engineer. They naturally look to the State Board of Health for all the advice and aid they need. We invariably give the best we have, but having no engineer the Board can not possibly do all that should be done. Such an officer, by visiting the different towns and inspecting their sanitary conditions, would be able to make suggestions that would save the lives of many of the State's inhabitants, and we earnestly urge the creation of such an office.

Stockton State Hospital.

The general management of the institution is excellent, the halls and wards are clean, the food good and nourishing, and the patients in good condition. The toilets and bathtubs, however, are pretty nearly all they should not be. Put in many years ago they are well-worn relics of a former age, and with the plumbing should as soon as possible be replaced with modern fixtures.

We must call attention to the utter lack of modern modes and facilities, not only in this institution but in all others of the same kind, for treating and observing the acute insane. Observation pavilions should be erected for the purpose of watching the new cases as they come into the hospital. The treatment of to-day for the insane is the electric light and the hydrotherapeutic. At present there are absolutely no ways of giving these kinds of treatment. We recommend these improvements, knowing that they would be of great benefit to the patients and a vast saving to the State by quickly curing a great number of cases.

The female side of the hospital is worthy of special mention. The walls are hung with pictures, and potted plants in the halls give to them a freshness and homelike air that must be pleasant to the sick minds of the patients.

The new farm of 500 acres is a fine addition to the hospital facilities, and will make an excellent place for outside colonies of patients.

Mendocino State Hospital.

The general sanitary condition of this institution is good. The halls and wards are clean and free from odor, and the health of the inmates excellent. The septic tank which was instituted three years ago has worked night and day without attention or expense, and it is a complete success. The reservoir has been cleaned and enlarged, so that the supply of water is better than two years ago.

The dairy is still excellent, but the same need of new up-to-date dairy buildings exists, and we repeat the same recommendation made in our last report, for an appropriation sufficient for this improvement.

This was the first State hospital in California to install an outdoor department for any class of patients, and its success has been such that all the others should follow the example. This question is of such vital importance to the health of the patients that we quote extensively from the report of Dr. King, Superintendent of the Hospital:

"Tent Life at the Hospital.—The tent plant, which consisted originally of seven tents, has been enlarged by the addition of five wooden structures built of 2 by 3 surfaced studding covered with double-surfaced rustic so as to be painted on both sides. These wooden structures

are 9 feet high on the sides, the roof being shingled. They are built with ventilators of sufficient capacity so that when open the air of the room will be pure and fresh. One of these buildings we use for a sitting-room, one for a dining-room, one for a dormitory, one for a hospital, and one for the attendants.

"The wooden buildings are somewhat more costly, but they will last much longer than the canvas and are better adapted to the class of patients (chronic insane) which we have under treatment there. Around the whole we have a 6-foot smooth woven-wire fence, inclosing about $2\frac{1}{2}$ acres of ground. This camp is conveniently located near the hospital and is connected with our water, electric light, steam, and sewer systems. Food is furnished from the main kitchen. Within the inclosure are plenty of shade trees, sunlight, and pure fresh air.

"We have in this camp at present 69 patients, which is a little more than it was designed to hold. The results of treatment at this camp during the last year show that outdoor life is not only better for tubercular patients, but also for those who are mentally unsound, and I might add for the sane as well.

"Dr. R. A. Cushman, First Assistant Physician, who has had charge of this camp since it was opened, reports as follows: 'The general health of the outdoor patients has been better than that of those who sleep on the wards! No cases of lung or bronchial inflammation have so far occurred in camp, while our greatest mortality during the winter months on the wards is from pneumonia. This is not said to cast any reflection on the sanitary condition of the wards, for they are well kept and well ventilated, but rather to show that patients who spend most of their time out of doors are remarkably free from colds and from bronchial and lung diseases.'

"It has also been found that old men and the demented patients who are inclined to be filthy have markedly improved when given an opportunity to have a continuous outdoor life. Their general health is much improved, they are more cleanly in their habits, and are much more contented and happy than when confined to the wards.

• "This camp, which can easily accommodate sixty patients, was built at a cost of \$3,600, or \$60 per bed, about one tenth of the cost of beds in ward buildings.

"Since the camp was opened three tubercular cases have become sane, and have been discharged. At the time of their discharge they had no fever, no cough, the chest dullness had practically disappeared, and they had increased in weight. At the present time we have three active tubercular cases and twelve tubercular cases improved. None of the improved cases have had any fever for several months; they have no cough, and most of them are gaining in weight. All the demented cases in camp have shown marked improvement, except the cases of

paresis, and we think that even in these cases their lives have been much prolonged.

"This tent plant, which was built for the accommodation of our male tuberculous cases, has proved of great value to that class. It has done more: it has demonstrated its value as a place for the care and treatment of a large class of our chronic insane, and I can see no reason why, with some modification, acute cases could not be cared for in the same manner and with advantage to the patients. In our California climate such buildings could be utilized for a farm colony of chronic cases and for epileptic colonies, with great benefit to the patients and economy to the State. In these tent colonies everything that reminds one of a prison is eliminated. The patients have more freedom; there is no lock except the one on the gate entrance, and this is simply to keep the old and demented patients from wandering away."

Napa State Hospital.

This hospital now contains 1,600 patients, the largest number it has ever had. The buildings are becoming crowded, and additions should be made thereto, as the prospects are that more and more patients are coming. The institution is kept right up to its best in every way. The food is excellent, the quarters are kept scrupulously clean, and the sanitary necessities are all that modern plumbing affords. The system of plumbing which was installed last year seems to be perfect. Dr. Stone has in contemplation the erection of detention and observation cottages, to which all new patients will be assigned for the purposes of observation and treatment. All modern appliances for the treatment of the insane, such as steam and hot-air baths, apparatus for electric and electric-light treatments, etc., are to be installed, and are recommended as an urgent necessity by this Board. The water supply will be much improved and increased when the new dam, which is now in process of construction, is completed. The dairy is in excellent condition and well taken care of. We recommend the isolation of tuberculous patients and their outdoor housing just as soon as it can possibly be accomplished.

Southern California State Hospital.

This hospital has been greatly improved since our last visit. A new administration building has been added, with the officers' rooms, superintendent's offices, trustees' rooms, visitors' waiting-rooms, library, officers' dining-room, etc., on the first floor; bacteriological laboratories and attachés' dining-room in the basement. The second floor is used for the sleeping apartments of the resident physicians and other officers, for guest chambers and bathrooms; the top story is given over entirely

to patients. The impression on entering this new building is a very pleasant one and takes away all feeling of entering an insane asylum; it is more like entering a beautiful country hotel.

This institution has improved very much under the management of Dr. Williamson, and bids fair to rival any of our State hospitals. There are now over 800 patients in the hospital and they are constantly on the increase. Like other institutions of this kind, the Southern California State Hospital is badly crowded and needs more room. When the tuberculous patients are housed in tents and open-air pavilions there will be more room in the buildings for other patients.

Detention and observation pavilions for the purpose of diagnosing and treating new cases are necessary for carrying on good work at this institution, and are recommended as important by this Board.

The septic tank has been a perfect success, it being practically odorless and its contents making an excellent fertilizer.

The hogpens deserve special mention. They contain about 400 hogs. The hogs and the pens are kept in perfect sanitary condition.

The dairy is still in a condition which might be improved upon.

State Hospital at Agnews.

This hospital was destroyed by the catastrophe of April 18, 1906, and will have to be entirely rebuilt. This should be done only after careful consideration of all the elements entering into the wellbeing of such an institution. The welfare of the patients is of the first consideration, expense second, and pride last. It is the belief of this Board that buildings intended for the care of the insane should be built far more simply than has been the practice in the past. In the tent ward at Ukiah, where the cost of structure is only \$60 per bed, better results are being obtained than in the large buildings that cost \$600. Manifestly there efficiency and economy go hand in hand, and only pride would suggest huge piles of brick or stone. It is not necessary to sacrifice taste and beauty, for they can go with more modest buildings, as cheapness does not indicate a want of taste. In small buildings, where the patients will be under less restraint, and where they can be better segregated, their mental sickness will more rapidly disappear and a saving be made to the State.

Home for Feeble-Minded Children.

This institution was badly damaged by the earthquake, but none of its inmates were seriously injured, and they are now being cared for in temporary barracks where they get a large supply of fresh air and light. Their health, as would be expected, is excellent, and is proof of the folly of erecting huge piles of brick and stone, where rooms and

halls get little air and less sunlight. From the standpoint of economy, as well as from that of sanitation and efficiency, the style of hospitals should be changed.

The general sanitary conditions are good. There is great need of more water, but when the new reservoir, now in process of construction, is completed this will be supplied.

In Stoneman Hall, where the lower grades of inmates are kept, there is great need of a covered platform, with sides of glass that could be removed in the summer season, where the unfortunates can play in the sun and air.

The sewer system is being improved. A septic tank was partially installed two years ago, but it was never completed. A small appropriation should be made to complete this work and make it perfect.

The dairy building has been improved since last report, but can never be made satisfactory. An entirely new milking-shed and milk-house should be built, so that the milk, which is the best food the children can have, can be kept pure and clean.

State Prison at Folsom.

The general high sanitary standard of this prison has been maintained since the last report, and there is little to criticise adversely or improvements to suggest.

State Prison at San Quentin.

With buildings old and dilapidated, with plumbing and drainage put in before sanitary science was developed, and with a limited water supply, that there is not more sickness than there is speaks well for the efficiency of the management. It is needless to go down the list of criticisms where there is so little good to be found, especially as complete reconstruction has been decided upon and commenced. The management has done everything possible for good sanitary conditions, but it is handicapped by old and wornout buildings.

State Capitol.

The last Legislature made a large appropriation for the purpose of remodeling this building, and it is now in process of reconstruction. When completed it will be well ventilated, well drained, and clean, and can be easily kept in a sanitary condition.

Whittier State School.

This school is in about the same condition we found it two years ago. A great many improvements could be made in the line of plumbing, furniture, interior comfort, gymnasiums, bathing facilities, swimming

tanks, etc., which would add to the utility of the institution. The girls' department seems to be very much superior in equipment to that of the boys. An ice plant is absolutely necessary. Although it was recommended in our last report, no steps toward establishing one have been taken. The temperature at Whittier is very high during the summer months, and milk, meat, vegetables, etc., decompose very rapidly, and an ice plant would be a great saving to the institution.

The sanitary conditions and appliances are pretty good, but could be improved upon. The septic tank disposes of the sewage to good satisfaction.

On our last visit we found that the boys had been taken to Catalina Island for a three weeks' outing, where they live in tents and are boating, swimming, and fishing all day. This outing takes place every year, and when the boys come home the girls are sent to the island.

Preston School of Industry.

Two years ago we earnestly recommended an ice plant and a septic tank for the school, and renew it with increased emphasis now. The ice plant from the standpoint of economy as well as of health, and the septic tank as a protection to life. The State should not violate its own laws nor poison its own people.

Institution for the Deaf and the Blind.

For cleanliness and order this institution can not be beaten anywhere, and from a sanitary standpoint no suggestions are needed. A septic tank to destroy the drainage from the stable is being considered, and if successful will remove the worst feature of the place. The dairy building is one of the best in the State, and by the installation of cement feed boxes, which could be flushed clean daily, would be about perfect.

State University.

The sanitary conditions of the State University at Berkeley have been materially improved since the last report. A new and complete sewer system has been put in and the old plumbing of the buildings is being gradually replaced with new.

Our recommendation of two years ago, that a hospital for the students be furnished, has been followed, and in a short time a complete one will be at their service, supported by a small fee charged to each. This, from the point of view of a health board, is a most important improvement.

California Polytechnic School, San Luis Obispo.

This is the latest State educational institution, and from a sanitary standpoint there is little to criticise.

Industrial Home of Mechanical Trades for Adult Blind.

This is perhaps as poorly equipped as any of the State institutions. The buildings are old and overcrowded, and the plumbing is very unsatisfactory. For the want of room, some of the inmates are obliged to sleep in halls that are almost without light and ventilation. While light is unnecessary for the blind in the matter of vision, it is absolutely necessary for health that every sleeping apartment have a goodly amount of sunlight. These halls have practically none. That the institution has little sickness among its inmates and no zymotic diseases, speaks exceedingly well for its management, but the time may come when even good management and care can not offset the want of nature's purifiers and disinfectants—air and light.

The new shops which are so greatly needed will be built shortly, when one great danger to the lives of the inmates will be done away with. There is great need for a new building, as the present ones are too full for healthful conditions, and the large waiting list requires that it be built.

Veterans' Home at Yountville.

There can be no adverse criticism on the management of this institution in sanitary matters. Every precaution is taken to guard the health of the old soldiers. The food is good and well cooked; the tables and barracks clean. The tubercular inmates are segregated and the hospital is well kept. While the dairy buildings are all of wood, they are kept scrupulously clean. The reserve water supply is not as large as it should be for the proper protection of the institution, and the dam should be enlarged. The sewage, while not a menace to the health of the inmates, is a source of danger to the people below, as it flows into a small stream which empties into the Napa River. This river is a source of domestic water supply, and typhoid fever has prevailed among those using it. There is an excellent location for a septic tank and filtration plant, and this should be installed at once. The State has no right to violate its own laws, and jeopardize the lives of its inhabitants. Already threats have been made to enjoin the State, and we recommend and insist that an appropriation be made to install such a plant.

State Normal School at San Francisco.

One good result of the fire in San Francisco was the destruction of the old Normal School building. A new one will soon take its place, and we will then have the satisfaction of knowing that teachers are being instructed in sanitary surroundings.

State Normal School at San Diego.

Sanitary conditions are good. Ventilation, drainage, light, and air are all we could desire.

State Normal School at San José.

This institution was so badly damaged by the earthquake of April 18 that it will have to be reconstructed.

State Normal School at Los Angeles.

The general sanitary conditions of the school are fair. The plumbing seems to be in good condition. The warm air that is used for heating the various rooms is drawn through several layers of coal that is kept damp, and in this manner the dust and other noxious materials are removed before the air enters the school rooms. The foul air is also removed from the rooms. The school has a well-organized gymnasium for the development of physical strength.

State Normal School at Chico.

The sanitary conditions are good and no appropriations are specially needed at the present time for this purpose.

Respectfully submitted.

MARTIN REGENSBURGER, M.D.,
President,

W. A. BRIGGS, M.D.,
Vice-President,

N. K. FOSTER, M.D.,
Secretary,

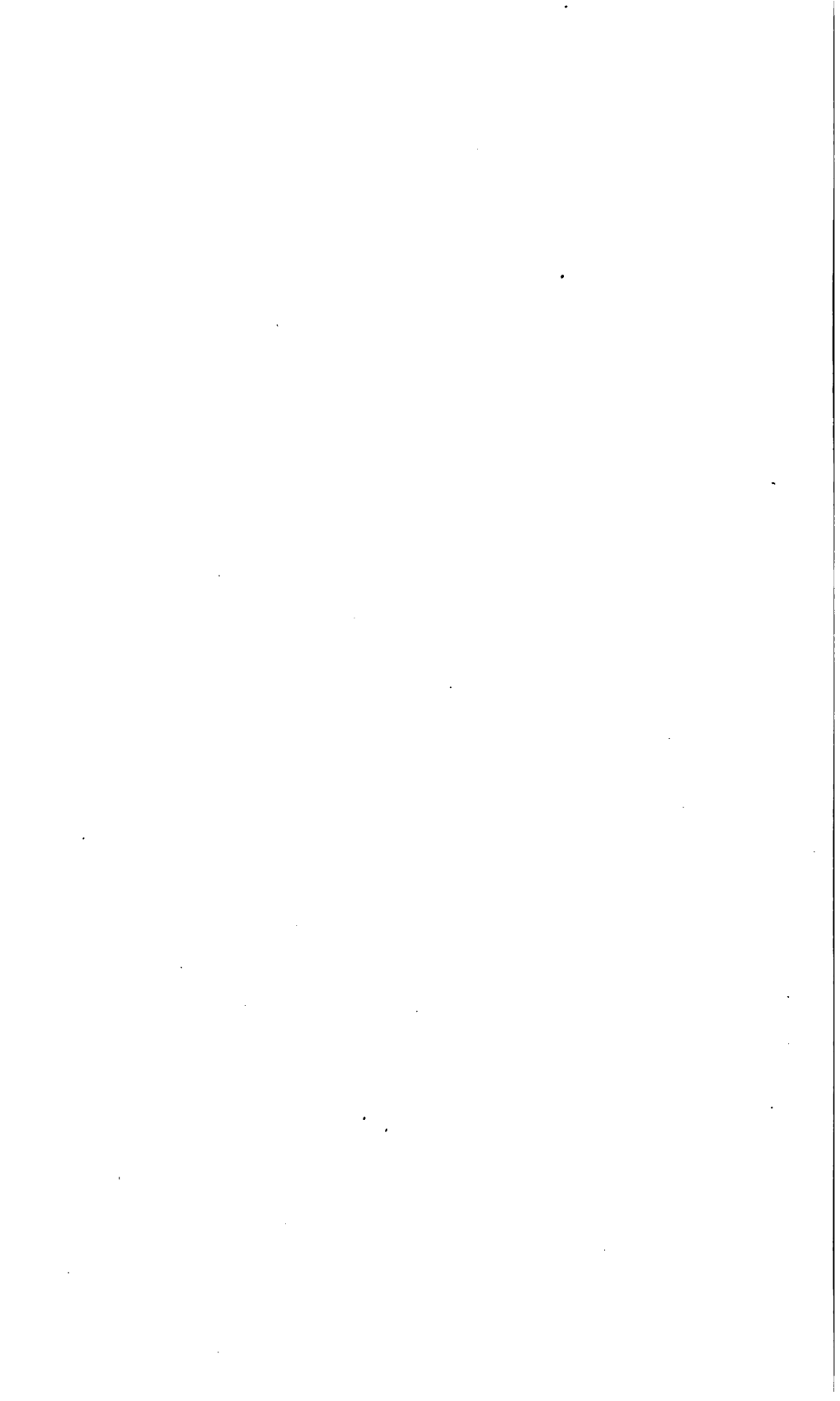
F. K. AINSWORTH, M.D.,

A. C. HART, M.D.,

O. STANSBURY, M.D.,

W. LE MOYNE WILLS, M.D.,

State Board of Health.



CONTAGIOUS DISEASE FUND.

Statement Showing Condition of Appropriation for Prevention of Contagious Diseases.

FIFTY-SIXTH FISCAL YEAR.	
By balance of appropriation of	
March 20, 1903.....	\$81,534 71
To warrants drawn as follows:	
No. Date—1904.	Amount.
624—July 20.....	\$40 00
1008—July 30.....	1,015 00
2142—Aug. 30.....	1,015 00
3104—Sept. 30.....	1,015 00
3838—Oct. 24.....	75 20
4375—Nov. 1.....	1,015 00
4721—Nov. 17.....	48 95
5193—Nov. 30.....	1,015 00
5584—Dec. 3.....	68 60
6664—Dec. 31.....	1,027 50
1905.	
10379—Jan. 31.....	1,108 92
10407—Feb. 2.....	30 00
14194—Feb. 28.....	1,018 35
17298—Mar. 31.....	450 00
18169—April 29.....	437 83
18892—May 4.....	185 00
19753—May 31.....	445 00
20402—June 17.....	65 65
20895—June 30.....	235 00
	\$10,311 00
To balance.....	71,223 71
	\$81,534 71

FIFTY-SEVENTH FISCAL YEAR.	
By balance of appropriation of	
March 20, 1903.....	\$71,223 71
To warrants drawn as follows:	
No. Date—1905.	Amount.
1684—Aug. 12.....	\$134 25
2596—Sept. 6.....	17 25
3681—Oct. 4.....	11 25
4234—Oct. 27.....	25 00
1906.	
8126—Jan. 31.....	75 00
9860—Mar. 20.....	15 40
10678—April 6.....	11 65
11567—May 2.....	36 25
11766—May 15.....	59 70
11925—May 28.....	12 50
12506—June 2.....	133 00
	\$531 25
To balance.....	70,692 46
	\$71,223 71

PRINTING FUND.

Statement Showing Amount of Printing Done for State Board of Health during the Fifty-sixth Fiscal Year.

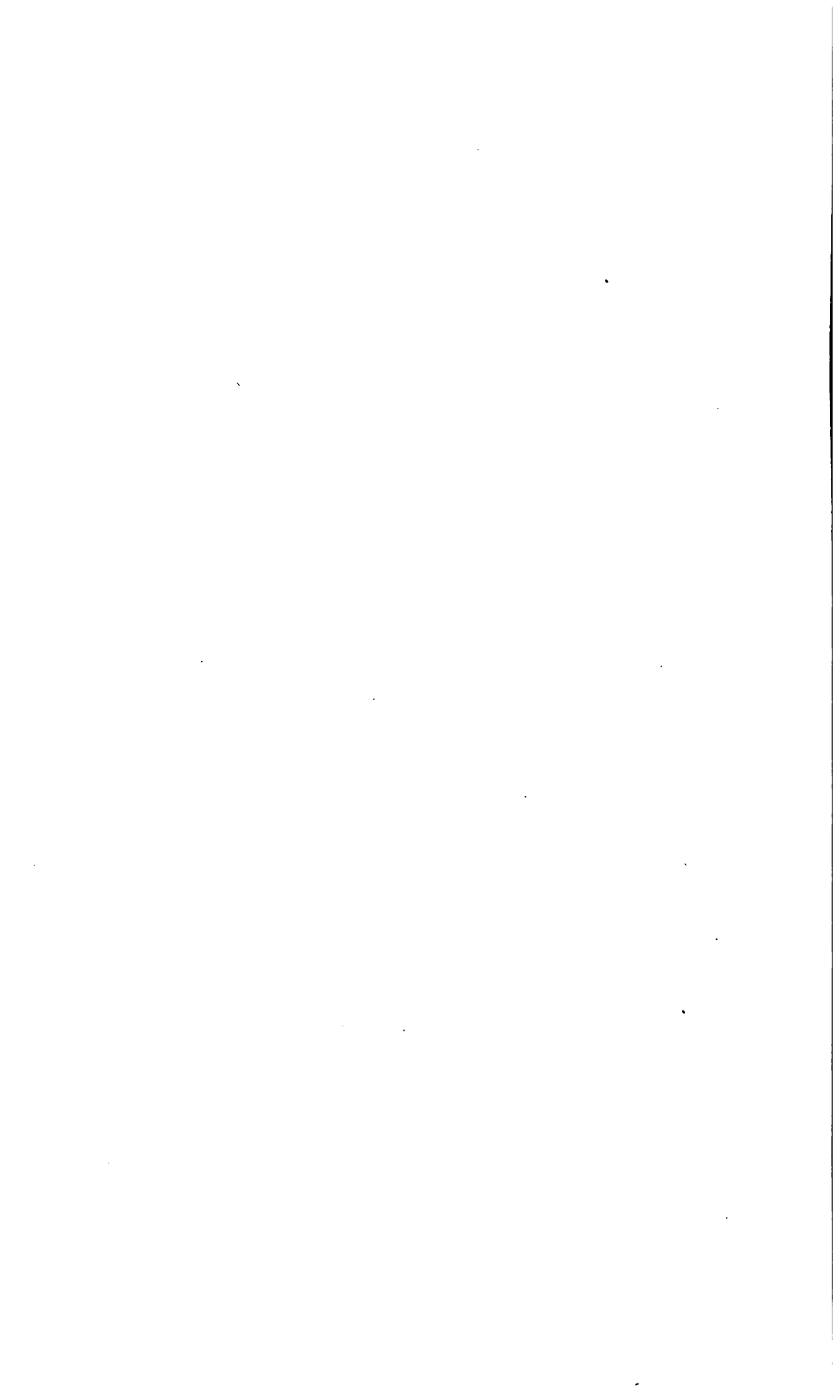
By appropriation for fifty-sixth fiscal year.....		\$750 00
By balance from fifty-fifth fiscal year.....		337 25
Total.....		<u>\$1,087 25</u>
1904—July—		
300 Monthly Bulletins for June.....	\$15 50	\$15 50
August—		
1,000 Envelopes, No. 9.....	\$5 00	
300 Monthly Bulletins for July.....	15 00	
		20 00
September—		
300 Monthly Bulletins for August.....	\$15 25	15 25
October—		
300 Monthly Bulletins for September.....	\$15 50	
150 Programs.....	7 50	
		23 00
November—		
250 Monthly Bulletins for October.....	\$5 50	5 50
December—		
2,000 Blank Sheets.....	\$1 00	
1,000 Biennial Reports.....	167 00	
300 Monthly Bulletins for November.....	6 00	
		174 00
1905—January—		
500 Monthly Bulletins for December.....	\$7 25	7 25
February—		
500 Monthly Bulletins for January.....	\$9 75	9 75
March—		
300 Monthly Bulletins for February.....	\$8 00	8 00
April—		
150 Programs.....	\$6 50	
300 Monthly Bulletins for March.....	6 00	
		12 50
May—		
625 Letter Heads, Typewriter.....	\$3 50	
300 Monthly Bulletins for April.....	9 25	
500 Birth Certificates.....	12 50	
500 Supplemental Reports of Births.....	6 50	
500 Marriage Certificates.....	12 50	
1,000 Death Certificates, Original.....	17 25	
1,000 Death Certificates, Duplicate.....	11 75	
500 Reports of "No Deaths".....	5 25	
		78 50
June—		
2,500 Directions to Registrars of Deaths.....	\$26 50	
40 Board Covers.....	2 00	
120 Covers.....	8 75	
300 Monthly Bulletins for May.....	10 75	
4,000 Envelopes, No. 6½.....	12 00	
1,000 Envelopes, No. 9.....	5 00	
5 Forms for Vital Statistics (electros).....	47 00	
3,000 Registration Laws.....	55 00	
10,000 Chapters Health Laws.....	317 50	
500 Letter Heads, each member.....	18 00	
250 Envelopes, No. 6½, each member.....	10 75	
4,000 Envelopes, No. 6½.....	13 25	
1,000 Envelopes, No. 9.....	5 00	
2,000 Notices to Undertakers.....	12 00	
3,000 Rules.....	95 00	
2,000 Forms, Cause of Death.....	46 75	
1,000 Registered District Forms.....	31 25	
500 Letter Heads, Typewriter.....	1 50	
		718 00
		<u>\$1,087 25</u>

PRINTING FUND—Continued.

Statement Showing Amount of Printing Done for State Board of Health during the Fifty-seventh Fiscal Year.

By appropriation for fifty-seventh fiscal year		\$1,000 00
1905—July—		
1,000 Reports of "No Deaths"	\$3 25	
1,000 Certificates of Death, Original	5 50	
500 Monthly Bulletins for June	15 25	
600 Manila Wrappers	50	
August—		\$24 50
2,000 Forms "Cause of Death," and Alterations	\$60 25	
1,000 Registered District Forms	23 00	
500 Cards, G. D. L.	3 00	
2,000 Letter Heads, and one-half furnished	4 25	
600 Manila Wrappers	50	
750 Monthly Bulletins for July	36 75	
1,000 Certificates of Birth	4 75	
1,000 Supplemental Reports of Births	3 75	
1,000 Certificates of Marriage	4 50	
150 Blank Sheets	2 00	
September—		142 75
2,000 Registrar's Accounts	\$12 50	
30,000 Index Cards	39 00	
2,000 Circular Letters, "Sec. 3077"	7 00	
1,000 Manila Wrappers	1 00	
750 Monthly Bulletins for August	35 50	
October—		96 00
1,000 Manila Wrappers	\$1 00	
800 Monthly Bulletins for September	34 50	
November—		35 50
1,000 Manila Wrappers	\$1 00	
800 Monthly Bulletins for October	36 75	
December—		37 75
240 Ruled Sheets (furnished)	\$0 75	
1,500 Health Officers' Reports	9 00	
1,000 Monthly Bulletins for November	36 75	
1906—January—		46 50
1,000 Manila Wrappers	\$0 75	
200 Blank Letter Heads, one half Typewriter	75	
1,000 Monthly Bulletins for December	27 25	
February—		28 75
500 Letter Heads, Typewriter (furnished)	\$2 25	
500 Letter Heads, Typewriter (furnished)	2 25	
1,200 Monthly Bulletins for January	48 75	
March—		53 25
1,000 Monthly Bulletins for February	\$31 75	
150 Programs	1 75	
2,000 Certificates of Death, Original	9 00	
37 Death Certificates. Binding	37 00	
April—		79 50
1,000 Monthly Bulletins for March	\$28 00	
4,000 Certificates of Death, Duplicate	11 50	
4,000 Certificates of Death, Original	11 50	
May—		51 00
3,000 Certificates of Birth	\$9 50	
3,000 Supplemental Reports of Birth	7 75	
3,000 Certificates of Marriage	9 50	
500 Envelopes, No. 6½, reg.	2 75	
600 Letter Heads, Typewriter, reg. (furnished)	2 50	
19 Death Certificates. Binding	19 00	
39 Birth Certificates. Binding	39 00	
1,000 Monthly Bulletins for April	25 50	
June—		115 50
29 Marriage Certificates. Binding	\$29 00	
1,000 Monthly Bulletins for May	25 50	
		54 50
		\$764 50
Balance in fund July 1, 1906		\$235 50

VITAL STATISTICS.



VITAL STATISTICS.

By GEORGE D. LESLIE.

SYNOPSIS OF REGISTRATION LAW.¹

The main points of interest to the general public in the present law for the registration of vital statistics in California may be summarized as follows:

The County Recorder is the sole local registrar for marriages. The local registrar of births is the City Health Officer in the few cities having freeholders' charters, and the County Recorder everywhere else. For deaths, the local registrar in cities having freeholders' charters is the City Health Officer; in other cities and incorporated towns, the City or Town Clerk; and for the remainder of each county, the County Recorder. When public convenience requires, the County Recorder as local registrar may, with the approval of the State Registrar, appoint subregistrars for designated portions of the county. Registrars are required to furnish without charge a sufficient number of copies of the proper certificate to each person upon whom is imposed the duty of certifying to a birth, marriage, or death. The chief duty of each local registrar and subregistrar, however, is to enforce the vital statistics law in his registration district.

The law applies particularly to clergymen, physicians, and undertakers. Every priest, minister of the gospel, justice, or judge who performs a marriage in this State, must within three days after the ceremony file with the County Recorder as local registrar a certificate properly filled out for the marriage performed by him.

Every physician, midwife, nurse, or other person assisting at a birth in California, must within five days thereafter file a certificate of birth with the local registrar, who is the County Recorder, except in the few cities having freeholders' charters, where the City Health Officer so acts. In case the child is not named when the certificate is filed, the local registrar will deliver to the person reporting the birth a supplemental blank for report of the given name, which must be filled out by the parents, next of kin, physician, or midwife, and returned as soon as the child shall be named, the name being then added by the local registrar to the certificate previously filed with him.

Every undertaker engaged for a funeral is held responsible for obtaining and filing a certificate of death with the local registrar or subregistrar, and securing a burial or removal permit prior to any disposition of the body. The local registrar for deaths is the City Health

¹Registration of Births and Marriages, Pol. C. §§3074-3083, as amended, Stats. 1905, Ch. CX, p. 103. Registration of Deaths, Stats. 1905, Ch. CXIX, p. 115, superseding Pol. C. §3084, repealed.

Officer in cities having freeholders' charters, the City or Town Clerk in other cities and incorporated towns, and the County Recorder for the remainder of each county, while subregistrars may also be appointed for designated portions of counties. Ordinarily the undertaker will obtain the personal and statistical particulars required over the signature (or name) and address of a relative or friend of the deceased, though the information may be given by any person, including the undertaker or physician, qualified to supply the facts. Besides the personal and statistical particulars, there is also the medical certificate of death, under which heading the physician certifies to the length of time the deceased received medical attendance, and also to the date and cause of death, including both the primary and immediate and the contributory causes, if any, and the duration of each. Special information is also required for hospitals, institutions, transients, or recent residents. In all cases where death occurs away from the former or usual residence, that residence must be given, together with the length of time at the place of death, and a statement of where the disease was contracted.

It is a misdemeanor for the State Registrar or for any clergyman, physician, undertaker, or other person, to fail, neglect, or refuse to perform any of the duties imposed upon him under the law for the registration of births, marriages, and deaths. It is also a misdemeanor for any local registrar, deputy registrar, or subregistrar to neglect or fail to enforce the provisions of the registration law in his district. At the instance of the State Registrar, the prosecuting attorney or other proper officer of any county or municipality shall forthwith initiate and promptly follow up the necessary court proceedings against parties responsible for alleged violations of the law.

STATISTICS OF BIRTHS: 1905-1906.

Summary.—For 1905-1906, the first year covered by the new birth registration law in California, there were reported a total of 20,909 living births.

San Francisco reported 5,250 births, or 25.1 per cent of all, followed by Los Angeles city, 3,128, and Oakland, 1,397, the cities with the next highest totals being Fresno, Sacramento, San José, Berkeley, Pasadena, and San Diego.

Among the counties, exclusive of freeholders' charter cities, the highest totals are for Santa Clara, 688, Los Angeles, 529, and Fresno, 429, followed by San Bernardino, Riverside, Orange, Tulare, Alameda, Butte, and San Joaquin.

For a State population of 1,784,521 in 1905, estimated conservatively by the Census Bureau method with slight modifications, the 20,909 births in 1905-1906 give a rate of 11.7 per 1,000 population.

The birth-rates are highest for the following cities: Fresno, 29.3; Santa Barbara, 26.9; Pasadena, 25.5; Santa Cruz, 25.0; Grass Valley, 23.7; Berkeley, 19.9, and San Bernardino, 18.6. The rates are also above 15.0 for the cities of Los Angeles, Napa, Watsonville, San José, Vallejo, and Oakland, as well as for the counties of Del Norte, Alpine, Riverside, Modoc, Tulare, Santa Clara, and Stanislaus.

The birth-rate is 14.1 for the twenty cities having freeholders' charters, against only 9.2 for all the rest of the State. Outside these cities where health officers are the registrars it is difficult to make physicians register births, but, nevertheless, several County Recorders as registrars for rural communities have secured complete returns.

The 20,909 babies included 10,835 boys and 10,074 girls, the per cent male being 51.8 and female 48.2. The white babies numbered 20,537, or 98.2 per cent of all, while there were 156 Japanese, 141 Chinese, 70 negroes, and 5 Indians.

No marked differences appear between localities, either in the proportion of the sexes or in the race distribution, though there are great differences in the nativity of the white mothers, especially between sections north and south of Tehachapi, and also between the metropolitan area and the rural counties.

The nativity of the 20,537 white mothers is as follows: Born in California, 7,683, or 37.4 per cent; born in other states (including 172, or 0.8 per cent, of unknown nativity), 7,478, or 36.4 per cent; and foreign born, 5,376, or 26.2 per cent.

South of Tehachapi the great bulk of the white mothers, 59.6 per cent of all, were born elsewhere in the United States than California. But north of Tehachapi, especially far north, the bulk were natives of

the Golden State, the per cent born here being 54.7 for Northern California and 43.2 for Central California.

In Northern and Central California, except in San Francisco and the other bay counties (Alameda, Contra Costa, Marin, and San Mateo), the per cent of white mothers born elsewhere in the United States than California is much greater than the per cent foreign born. For the metropolitan area, comprising San Francisco and the other bay counties, the per cents born in the Golden State and in other States are lower than for the rural counties of Northern and Central California. Conversely, the per cent foreign born among the white mothers is much higher for the metropolitan area than for the rural counties.

City and County Totals.—In accordance with the law of 1905, requiring all County Recorders and the Health Officers of the twenty cities having freeholders' charters, as ex officio local registrars, to transmit monthly to the State Registrar the original birth certificates filed with them, there have been registered in the State Bureau of Vital Statistics a total of 20,909 living births, 10,652 for the last half of 1905 and 10,257 for the first half of 1906. The destruction of over half a month's records for San Francisco in the fire of April 18-20, and the incomplete registration of births in the confused times succeeding this calamity caused the half-year total for that city to fall from 3,309 in 1905 to 1,941 in 1906, and also explains the slight falling off in the State total, the number of births registered outside the metropolis being considerably greater for the first six months of 1906 than for the last six months of 1905.

For births, the registration districts are cities having freeholders' charters, the rural portions of counties containing these cities, and rural counties without any such cities. Of the total 20,909 living births reported for the fiscal year 1905-1906, as many as 5,250, or 25.1 per cent of all, were registered in the City and County of San Francisco, notwithstanding the effects of the great fire in April. Among the freeholders' charter cities Los Angeles is second, with 3,128 living births for the year, and Oakland is third with 1,397. The next highest city totals reported to the State Bureau are: Fresno, 390; Sacramento, 389; San José, 379; Berkeley, 370; Pasadena, 287, and San Diego, 238. Between 100 and 200 living births were registered in Grass Valley, San Bernardino, Santa Barbara, Santa Cruz, Stockton, and Vallejo, and less than 100 for the year in Napa, Salinas, Santa Rosa, and Watsonville. Eureka is the only city having a freeholders' charter for which no vital statistics at all were reported in 1905-1906.

The highest totals for rural counties or the rural portions of counties with freeholders' charter cities are as follows: Santa Clara (outside San José), 688; Los Angeles (outside Los Angeles city and Pasadena), 529; Fresno (outside Fresno city), 429; San Bernardino (outside San Bernardino city), 349; Riverside, 341; Orange, 327; Tulare, 297; Alameda (outside Berkeley and Oakland), 288; Butte, 244, and San Joaquin (outside Stockton), 227. Between 100 and 200 living births were registered in the following rural counties or portions of counties: Calaveras, Contra Costa, El Dorado, Kern, Madera, Marin, Mendocino, Monterey (outside Salinas), Nevada (outside Grass Valley), Sacramento

(outside Sacramento city), San Luis Obispo, San Mateo, Santa Barbara (outside Santa Barbara city), Shasta, Siskiyou, Solano (outside Vallejo), Sonoma (outside Santa Rosa), Stanislaus, and Ventura.

In considering the rank of cities and counties in births reported, it should be understood that the returns are affected not only by the number of living births which actually occurred, but also by the proportion of those which occurred that have been duly registered as required by law. Comparison of the returns for various registration districts indicates that there are marked differences between the districts in the extent to which local registrars have secured a thorough enforcement of the registration law or in the extent to which physicians and midwives have obeyed the law by promptly registering all births.

Birth-rates.—This appears clearly when birth-rates are considered. In order to calculate rates the population of California in 1905 has been estimated conservatively according to the Census Bureau method by adding to the population in 1900 five tenths of the increase between 1890 and 1900, except that for the few counties showing decreases between the last two Federal censuses the population in 1900 has been taken for 1905. For the three principal cities arbitrary estimates have been made because of their exceptionally rapid growth, the estimate for San Francisco in 1905 being 450,000, for Los Angeles 180,000, and for Oakland 90,000. The variations from the standard method made by the Census Bureau in published estimates for Berkeley and San Diego have also been followed, while for other cities the same method of estimating population has been applied as explained above for counties.

For a State population, thus estimated, of 1,784,521 in 1905, the 20,909 living births reported for 1905-1906 give a birth-rate of 11.7 per 1,000 inhabitants. This is surpassed or equaled by the birth-rates for the thirty-one registration districts shown in the table below, the districts being arranged in descending order of birth-rates. The word "rural" after a county indicates that the figures relate to the county exclusive of its freeholders' charter city or cities. For the information of those interested in comparing birth-rates, or checking the calculations, the table gives the estimated population, 1905, and the living births, 1905-1906, as well as the birth-rate per 1,000 population.

TABLE 1.—*Registration Districts with Birth-rates above or equal to the State Average (11.7): 1905-1906.*

REGISTRATION DISTRICT.	Estimated Population: 1905.	Living Births: 1905-1906.	Birth-rate per 1,000 Population.
Fresno city	13,295	390	29.3
Santa Barbara city	6,949	187	26.9
Pasadena city	11,235	287	25.5
Santa Cruz city	5,681	142	25.0
Grass Valley city	4,801	114	23.7
Berkeley town	18,600	370	19.9
San Bernardino city	7,219	134	18.6
Del Norte county	2,408	43	17.9
Alpine county	509	9	17.7
Los Angeles city	180,000	3,128	17.4
Riverside county	20,140	341	16.9
Napa City	4,036	68	16.8
Modoc county	5,121	85	16.6
Watsonville city	4,218	69	16.4
San José city	23,220	379	16.3
Tulare county	18,375	297	16.2
Vallejo city	8,778	141	16.1
Santa Clara county, rural	43,102	688	16.0
Oakland city	90,000	1,397	15.5
Stanislaus county	9,550	147	15.4
Fresno county, rural	29,784	429	14.4
Orange county	22,750	327	14.4
San Bernardino county, rural	24,222	349	14.4
Butte county	17,117	244	14.3
Madera county	7,247	103	14.2
El Dorado county	8,986	124	13.8
Lake county	6,017	82	13.6
Santa Barbara county, rural	13,575	180	13.3
Sacramento city	30,732	389	12.7
San Diego city	18,900	238	12.6
San Francisco city	450,000	5,250	11.7

In addition to the districts ranked in the above table, the only ones with annual birth-rates of at least 10.0 are Santa Rosa city and the counties of Calaveras, Marin, San Benito, San Mateo, San Joaquin (outside Stockton), Sierra, and Sutter.

It will be observed that the registration districts with high birth-rates include nearly all the cities having freeholders' charters, Salinas with 9.8 and Stockton with 8.8 being the only cities with rates below 10.0, and Eureka being the only freeholders' charter city not reporting vital statistics. In fact, for the twenty freeholders' charter cities, with a total estimated population of 916,459, the 12,962 births give a birth-rate of 14.1 per 1,000 inhabitants. But for all the rest of the State, with an estimated population of 868,062, the 7,947 births give a birth-rate of only 9.2, or 4.9 less in each 1,000 than for the cities. As a rule, it is more difficult to secure complete registration of births in rural districts than in urban centers, though there are several counties where the Recorders as local registrars have obtained satisfactory returns of births.

Sex and Race.—The proportion of the sexes among the 20,909 children born in 1905-1906 is: Male, 10,835, or 51.8 per cent; and female, 10,074, or 48.2 per cent. The race distribution is: White, 20,537, or 98.2 per cent; Japanese, 156, or 0.8 per cent; Chinese, 141, or 0.7 per cent; negro, 70, or 0.3 per cent; Indian, 5, or less than one-tenth of 1 per cent. The per cents male and female are the same for the white as for all children, 51.8 and 48.2 per cent, respectively, but among the 372 non-Caucasians the males were 198, or 53.2 per cent, and the females 174, or 46.8 per cent.

No marked differences appear between various sections of California, either in the proportion of the sexes or in the race distribution. Thus, among the several geographic divisions into which the fifty-seven counties of the State have been grouped the per cent male varies only from 52.9 for the interior counties of Central California to 51.1 for the interior counties of Northern California and for the coast counties of Central California. Similarly, the per cent white ranges only from 99.1 for the six counties of Southern California other than Los Angeles to 97.1 for the City and County of San Francisco.

Table 2, below, gives the proportion of the sexes and also the race distribution, in detail, for each geographic division of the State described more particularly on page 86 of this Report, as well as for the metropolitan area in contrast with the rural counties north of Tehachapi.

TABLE 2.—*Living Births classified by Sex and by Race, with Per Cent Distributions, for Geographic Divisions: 1905-1906.*

Geographic Division.	Living Births: 1905-1906.	Male.	Female.	White.	Negro.	Indian.	Chinese.	Japanese.
NUMBERS.								
THE STATE.....	20,909	10,835	10,074	20,537	70	5	141	156
<i>Northern California</i>	2,080	1,058	1,002	2,038	1	4	9	8
Coast counties.....	680	358	332	681	-----	4	2	3
Interior counties....	1,370	700	670	1,357	1	-----	7	5
<i>Central California</i>	12,886	6,672	6,214	12,618	29	-----	120	119
San Francisco.....	5,250	2,695	2,555	5,098	5	-----	92	55
Other bay counties....	2,522	1,306	1,216	2,481	13	-----	5	23
Coast counties.....	1,786	912	874	1,752	2	-----	7	25
Interior counties....	3,328	1,759	1,569	3,287	9	-----	16	16
<i>Southern California</i>	5,963	3,105	2,858	5,881	40	1	12	29
Los Angeles.....	3,944	2,058	1,886	3,881	35	-----	9	19
Other counties.....	2,019	1,047	972	2,000	5	1	3	10
<i>Northern and Central California</i>	14,946	7,730	7,216	14,656	30	4	129	127
Coast counties.....	10,248	5,271	4,977	10,012	20	4	106	106
Interior counties....	4,698	2,459	2,239	4,644	10	-----	23	21
Metropolitan area....	7,772	4,001	3,771	7,579	18	-----	97	78
Rural counties.....	7,174	3,729	3,445	7,077	12	4	32	49
PER CENTS.								
THE STATE.....	100.0	51.8	48.2	98.2	0.3	*	0.7	0.8
<i>Northern California</i>	100.0	51.4	48.6	98.9	0.1	0.2	0.4	0.4
Coast counties.....	100.0	51.9	48.1	98.7	-----	0.6	0.3	0.4
Interior counties....	100.0	51.1	48.9	99.0	0.1	-----	0.5	0.4
<i>Central California</i>	100.0	51.8	48.2	98.0	0.2	-----	0.9	0.9
San Francisco.....	100.0	51.3	48.7	97.1	0.1	-----	1.8	1.0
Other bay counties....	100.0	51.8	48.2	98.4	0.5	-----	0.2	0.9
Coast counties.....	100.0	51.1	48.9	98.1	0.1	-----	0.4	1.4
Interior counties....	100.0	52.9	47.1	98.7	0.3	-----	0.5	0.5
<i>Southern California</i>	100.0	52.1	47.9	98.6	0.7	*	0.2	0.5
Los Angeles.....	100.0	52.2	47.8	98.4	0.9	-----	0.2	0.5
Other counties.....	100.0	51.9	48.1	99.1	0.2	*	0.2	0.5
<i>Northern and Central California</i>	100.0	51.7	48.3	98.1	0.2	*	0.9	0.8
Coast counties.....	100.0	51.4	48.6	97.7	0.2	0.1	1.0	1.0
Interior counties....	100.0	52.3	47.7	98.9	0.2	-----	0.5	0.4
Metropolitan area....	100.0	51.5	48.5	97.5	0.2	-----	1.3	1.0
Rural counties.....	100.0	52.0	48.0	98.6	0.2	0.1	0.4	0.7

s than one tenth of 1 per cent.

Nativity of Mothers.—However, there are great differences between certain sections of the State in the nativity of the mothers of the white children. These differences are shown in the table below, giving the number and per cent of white mothers born in California, born in other states, and foreign born. The few of unknown nativity, numbering only 172, or 0.8 per cent of all in the entire State, have been included with those born elsewhere in the United States than California. Figures are shown for each of the geographic divisions of the State, and also for the metropolitan area, comprising San Francisco and the other bay counties (Alameda, Contra Costa, Marin, and San Mateo), in contrast with the rural counties of Northern and Central California.

TABLE 3.—*White Mothers classified by Nativity, with Per Cent Distributions, for Geographic Divisions: 1905-1906.*

Geographic Division.	Total White Mothers.	Born in California.	Born in Other States.	Foreign Born.	Per Cent.		
					Born in California.	Born in Other States.	Foreign Born.
THE STATE.....	20,537	7,683	7,478	5,376	37.4	36.4	26.2
Northern California.....	2,038	1,114	650	274	54.7	31.9	13.4
Coast counties.....	681	331	220	130	48.6	32.3	19.1
Interior counties.....	1,357	783	430	144	57.7	31.7	10.6
Central California.....	12,618	5,456	3,325	3,837	43.2	26.4	30.4
San Francisco.....	5,098	2,136	943	2,019	41.9	18.5	39.6
Other bay counties.....	2,481	1,039	723	719	41.9	29.1	29.0
Coast counties.....	1,752	782	548	422	44.6	31.3	24.1
Interior counties.....	3,287	1,499	1,111	677	45.6	33.8	20.6
Southern California.....	5,881	1,113	3,503	1,265	18.9	59.6	21.5
Los Angeles.....	3,881	598	2,360	923	15.4	60.8	23.8
Other counties.....	2,000	515	1,143	342	25.8	57.1	17.1
Northern and Central California.....	14,656	6,570	3,975	4,111	44.8	27.1	28.1
Coast counties.....	10,012	4,288	2,434	3,290	42.8	24.3	32.9
Interior counties.....	4,644	2,282	1,541	821	49.1	33.2	17.7
Metropolitan area.....	7,579	3,175	1,666	2,738	41.9	22.0	36.1
Rural counties.....	7,077	3,395	2,309	1,373	48.0	32.6	19.4

It appears from the preceding table that of the 20,537 white mothers bearing children in California in 1905-1906, 7,683, or 37.4 per cent, were natives of the Golden State; 7,478, or 36.4 per cent, were natives of other states, and 5,376, or 26.2 per cent, were foreign born. The per cents for Southern California, however, differ greatly from those for either Northern or Central California.

South of Tehachapi the great bulk of the white mothers, 59.6 per cent of all, were born in other states than California. In Los Angeles county the per cent foreign born is even greater than the per cent born in California, though in the other six counties south of Tehachapi the California born mothers at least outnumber the foreign born.

North of Tehachapi, especially far north, the bulk of the white mothers were natives of the Golden State, the per cent born here being

54.7 for Northern California and 43.2 for Central California. In each division of Northern and Central California, except only in San Francisco, the per cent born elsewhere in the United States than California is greater, and except for the other bay counties is much greater than the per cent foreign born.

In San Francisco, as in the rest of Northern and Central California, most of the white mothers were natives of the Golden State. In the metropolis, however, the native daughters bearing children are followed closely by the foreign born, the per cent being 41.9 for the former and 39.6 for the latter, while those born elsewhere in the United States than California comprise only 18.5 per cent of all the white mothers. In the other bay counties (Alameda, Contra Costa, Marin, and San Mateo), where, as in San Francisco, 41.9 per cent of the white mothers were born in California, the per cent born in other states is about the same as the per cent foreign born, 29.1 against 29.0.

For the metropolitan area, comprising San Francisco and the other bay counties, the per cents of white mothers born in California and in other states are lower than the corresponding per cents for the remaining rural counties north of Tehachapi. Conversely, the per cent foreign born is much higher for the metropolitan area than for the rural counties of Northern and Central California.

TABLE 4.—*Estimated Population (1905), Living Births, and Birth-rate per 1,000 Population, for Registration Districts arranged Geographically: 1905-1906.*

Registration District.	Estimated Population: 1905.	Living Births: 1905-1906.	Birth-rate per 1,000 Population.
THE STATE.....	1,784,521	20,909	11.7
Northern California.....	269,510	2,060	7.6
Coast counties.....	121,785	690	5.7
Del Norte.....	2,408	43	17.9
Humboldt, rural.....	20,360	28	1.4
Eureka city.....	8,562	.....	.....
Lake.....	6,017	82	13.6
Mendocino.....	21,892	144	6.6
Napa, rural.....	12,435	81	6.5
Napa City.....	4,036	68	16.8
Sonoma, rural.....	33,960	159	4.7
Santa Rosa city.....	7,400	74	10.0
Trinity.....	4,715	11	2.3
Interior counties.....	147,725	1,370	9.3
Butte.....	17,117	244	14.3
Colusa.....	7,364	73	9.9
Glenn.....	5,150	38	7.4
Lassen.....	4,647	46	9.9
Modoc.....	5,121	85	16.6
Nevada, rural.....	13,198	128	9.7
Grass Valley city.....	4,801	114	23.7
Placer.....	16,129	43	2.7
Plumas.....	4,657	38	8.2
Shasta.....	19,911	161	8.1
Sierra.....	4,017	45	11.2
Siskiyou.....	19,362	176	9.1
Sutter.....	6,095	61	10.0
Tehama.....	11,536	54	4.7
Yuba.....	8,620	64	7.4
Central California.....	1,105,090	12,886	11.7
San Francisco.....	450,000	5,250	11.7
Other bay counties.....	216,127	2,522	11.7
Alameda, rural.....	57,100	288	5.0
Berkeley town.....	18,600	370	19.9
Oakland city.....	90,000	1,397	15.5
Contra Costa.....	20,312	135	6.6
Marin.....	17,017	186	10.9
San Mateo.....	13,098	146	11.1
Coast counties.....	132,371	1,786	13.5
Monterey, rural.....	15,965	147	9.2
Salinas City.....	3,787	37	9.8
San Benito.....	6,744	73	10.8
San Luis Obispo.....	16,920	165	9.8
Santa Clara, rural.....	43,102	688	16.0
San José city.....	23,220	379	16.3
Santa Cruz, rural.....	12,734	86	6.8
Santa Cruz city.....	5,681	142	25.0
Watsonville city.....	4,218	69	16.4

TABLE 4.—*Estimated Population (1905), Living Births, and Birth-rate per 1,000 Population, for Registration Districts arranged Geographically: 1905-1906—Continued.*

Registration District.	Estimated Population: 1905.	Living Births 1905-1906.	Birth-rate per 1,000 Population.
<i>Central California—Continued:</i>			
Interior counties	306,592	3,328	10.9
Alpine	509	9	17.7
Amador	11,514	47	4.1
Calaveras	12,359	129	10.4
El Dorado	8,986	124	13.8
Fresno, rural	29,784	429	14.4
Fresno city	13,295	390	29.3
Inyo	4,794	30	6.3
Kern	19,816	161	8.1
Kings	12,044	77	6.4
Madera	7,247	103	14.2
Mariposa	5,187	23	4.4
Merced	9,780	57	5.8
Mono	2,250	6	2.7
Sacramento, rural	17,971	146	8.1
Sacramento city	30,732	389	12.7
San Joaquin, rural	19,818	227	11.5
Stockton city	19,046	168	8.8
Solano, rural	16,964	135	8.0
Vallejo city	8,778	141	16.1
Stanislaus	9,550	147	15.4
Tulare	18,375	297	16.2
Tuolumne	13,708	11	0.8
Yolo	14,085	82	5.8
<i>Southern California</i>	409,921	5,963	14.5
Los Angeles	259,000	3,944	15.2
Los Angeles, rural	67,765	529	7.8
Los Angeles city	180,000	3,128	17.4
Pasadena city	11,235	287	25.5
Other counties	150,921	2,019	13.4
Orange	22,750	327	14.4
Riverside	20,140	341	16.9
San Bernardino, rural	24,222	349	14.4
San Bernardino city	7,219	134	18.6
San Diego, rural	20,651	149	7.2
San Diego city	18,900	238	12.6
Santa Barbara, rural	13,575	180	13.3
Santa Barbara city	6,949	187	26.9
Ventura	16,515	114	6.9
<i>Northern and Central California</i>	1,374,600	14,946	10.9
Coast counties	920,283	10,248	11.1
Interior counties	454,317	4,698	10.3
Metropolitan area	666,127	7,772	11.7
Rural counties	708,473	7,174	10.1

TABLE 5.—*Living Births Classified by Sex, Race, and*

Registration District.	Living Births: 1905-1906.	Male.	Female.
THE STATE	20,909	10,835	10,074
<i>Northern California</i>	2,060	1,058	1,002
Coast counties	690	358	332
Del Norte	43	24	19
Humboldt, rural	28	14	14
Eureka city			
Lake	82	41	41
Mendocino	144	67	77
Napa, rural	81	45	36
Napa City	68	32	36
Sonoma, rural	159	84	75
Santa Rosa city	74	44	30
Trinity	11	7	4
Interior counties	1,370	700	670
Butte	244	122	122
Colusa	73	40	33
Glenn	38	14	24
Lassen	46	24	22
Modoc	85	47	38
Nevada, rural	128	60	68
Grass Valley city	114	54	60
Placer	43	27	16
Plumas	38	20	18
Shasta	161	82	79
Sierra	45	25	20
Siskiyou	176	88	88
Sutter	61	31	30
Tehama	54	33	21
Yuba	64	33	31
<i>Central California</i>	12,886	6,672	6,214
San Francisco	5,250	2,695	2,555
Other bay counties	2,522	1,306	1,216
Alameda, rural	288	150	138
Berkeley town	370	202	168
Oakland city	1,397	688	709
Contra Costa	135	78	57
Marin	186	103	83
San Mateo	146	85	61
Coast counties	1,786	912	874
Monterey, rural	147	73	74
Salinas City	37	15	22
San Benito	73	32	41
San Luis Obispo	165	77	88
Santa Clara, rural	688	345	343
San José city	379	212	167
Santa Cruz, rural	86	47	39
Santa Cruz city	142	75	67
Watsonville city	69	36	33

Nativity of Mothers, for Registration Districts: 1905-1906.

White.			Negro.	Indian.	Chinese.	Japa- nese.	White Mothers.			
Total.	Male.	Female.					Born in Calif- ornia.	Born in Other States.	For- eign Born.	Nativity Un- known.
20,537	10,637	9,900	70	5	141	156	7,683	7,306	5,376	172
2,038	1,043	995	1	4	9	8	1,114	617	274	33
681	351	330		4	2	3	331	210	130	10
43	24	19					14	25	4	
28	14	14					7	6	10	5
82	41	41					49	24	9	
139	63	76		4		1	87	35	16	1
81	45	36					34	17	29	1
68	32	36					37	23	8	
155	81	74			2	2	69	49	34	3
74	44	30					26	29	19	
11	7	4					8	2	1	
1,357	692	665	1		7	5	783	407	144	23
242	122	120			2		125	87	18	12
72	39	33			1		44	18	8	2
38	14	24					30	7	1	
46	24	22					29	14	2	1
85	47	38					48	33	4	
126	58	68			2		74	31	21	
114	54	60					67	22	23	2
38	23	15				5	22	12	3	1
38	20	18					23	6	9	
160	81	79	1				87	62	11	
45	25	20					37	6	2	
176	88	88					88	53	32	3
61	31	30					37	17	6	1
54	33	21					27	26		1
62	33	29			2		45	13	4	
12,618	6,527	6,091	29		120	119	5,456	3,244	3,837	81
5,098	2,612	2,486	5		92	55	2,136	921	2,019	22
2,481	1,279	1,202	13		5	23	1,039	716	719	7
286	149	137	1			1	126	66	93	1
365	199	166				5	148	139	78	
1,366	668	698	11		3	17	566	412	386	2
135	78	57					58	36	39	2
185	102	83			1		84	34	65	2
144	83	61	1		1		57	29	58	
1,752	895	857	2		7	25	782	530	422	18
135	66	69			2	10	72	24	39	
34	13	21			2	1	21	8	5	
72	32	40	1				45	15	12	
164	78	87			1		95	39	30	
685	344	341				3	248	225	197	15
376	210	166	1		2		161	116	96	3
83	45	38				3	41	28	14	
141	75	66				1	63	57	21	
62	33	29				7	36	18	8	

TABLE 5.—*Living Births Classified by Sex, Race, and Nativity*

Registration District.	Living Births: 1905-1906.	Male.	Female.
<i>Central California—Continued.</i>			
Interior counties	3,328	1,759	1,569
Alpine	9	5	4
Amador	47	26	21
Calaveras	129	70	59
El Dorado	124	63	61
Fresno, rural	429	225	204
Fresno city	390	202	188
Inyo	30	20	10
Kern	161	92	69
Kings	77	34	43
Madera	108	54	49
Mariposa	23	11	12
Merced	57	25	32
Mono	6	2	4
Sacramento, rural	146	74	72
Sacramento city	389	192	197
San Joaquin, rural	227	130	97
Stockton city	168	99	69
Solano, rural	135	68	67
Vallejo city	141	77	64
Stanislaus	147	87	60
Tulare	297	153	144
Tuolumne	11	9	2
Yolo	82	41	41
<i>Southern California</i>	5,963	3,105	2,858
Los Angeles	3,944	2,058	1,886
Los Angeles, rural	529	270	259
Los Angeles city	3,128	1,633	1,495
Pasadena city	287	155	132
Other counties	2,019	1,047	972
Orange	327	171	156
Riverside	341	188	153
San Bernardino, rural	349	188	161
San Bernardino city	134	69	65
San Diego, rural	149	67	82
San Diego city	238	130	108
Santa Barbara, rural	180	91	89
Santa Barbara city	187	85	102
Ventura	114	58	56
<i>Northern and Central California</i>	14,946	7,730	7,216
Coast counties	10,248	5,271	4,977
Interior counties	4,698	2,459	2,239
Metropolitan area	7,772	4,001	3,771
Rural counties	7,174	3,729	3,445

of Mothers, for Registration Districts: 1905-1906—Continued.

White.			Negro.	Indian.	Chinese.	Japa- nese.	White Mothers.			
Total.	Male.	Female.					Born in Cal- ifornia.	Born in Other States.	For- eign Born.	Nativity Un- known.
3,287	1,741	1,546	9	-----	16	16	1,499	1,077	677	34
9	5	4	-----	-----	-----	-----	7	2	-----	-----
47	26	21	-----	-----	-----	-----	29	12	6	-----
129	70	59	-----	-----	-----	-----	101	14	14	-----
123	63	60	-----	-----	1	-----	93	22	8	-----
426	223	203	2	-----	1	-----	116	189	120	1
384	200	184	4	-----	1	1	131	155	96	2
30	20	10	-----	-----	-----	-----	15	13	2	-----
155	89	66	-----	-----	3	3	49	63	43	-----
76	34	42	-----	-----	-----	1	27	36	12	1
103	54	49	-----	-----	-----	-----	43	33	19	8
23	11	12	-----	-----	-----	-----	18	3	1	1
57	25	32	-----	-----	-----	-----	24	9	24	-----
6	2	4	-----	-----	-----	-----	4	2	-----	-----
141	71	70	-----	-----	3	2	69	32	37	3
379	187	192	-----	-----	4	6	177	106	81	15
226	130	96	-----	-----	-----	1	108	74	43	1
165	99	66	1	-----	2	-----	108	36	21	-----
135	68	67	-----	-----	-----	-----	68	28	39	-----
138	75	63	2	-----	1	-----	71	24	43	-----
147	87	60	-----	-----	-----	-----	65	50	31	1
297	153	144	-----	-----	-----	-----	118	152	26	1
11	9	2	-----	-----	-----	-----	9	-----	2	-----
80	40	40	-----	-----	-----	2	49	22	9	-----
5,881	3,067	2,814	40	1	12	29	1,113	3,445	1,265	58
3,881	2,030	1,851	35	-----	9	19	598	2,337	923	23
527	269	258	2	-----	-----	-----	106	312	108	6
3,068	1,606	1,462	32	-----	9	19	461	1,821	770	16
286	155	131	1	-----	-----	-----	31	204	50	1
2,000	1,037	963	5	1	3	10	515	1,108	342	35
325	171	154	1	-----	-----	1	77	198	46	4
331	181	150	3	1	-----	6	57	213	51	10
349	188	161	-----	-----	-----	-----	51	237	60	1
133	69	64	1	-----	-----	-----	35	69	26	3
149	67	82	-----	-----	-----	-----	31	80	29	9
238	130	108	-----	-----	-----	-----	38	146	53	1
177	90	87	-----	-----	2	1	97	46	31	3
186	85	101	-----	-----	1	-----	84	66	36	-----
112	56	56	-----	-----	-----	2	45	53	10	4
14,656	7,570	7,086	30	4	129	127	6,570	3,861	4,111	114
10,012	5,137	4,875	20	4	106	106	4,288	2,377	3,290	57
4,644	2,433	2,211	10	-----	23	21	2,282	1,484	821	57
7,579	3,891	3,688	18	-----	97	78	3,175	1,637	2,738	29
7,077	3,679	3,398	12	4	32	49	3,395	2,224	1,373	85

PROPORTION OF CHILDREN: 1850 TO 1900.¹

Children to Potential Mothers.—The proportion of children to potential mothers, or women of child-bearing age, is the only index of the birth-rate available for past decades, since the registration of births for statistical purposes is comparatively recent either in the United States as a whole or in the single State of California. The proportion can be calculated from the figures of the Federal Census as far back as 1850, the year when California was admitted to the Union.

The following table shows the proportion of children under 5 years of age to women 15 to 49 years of age for continental United States and California at each census from 1850 to 1900:

	1900.	1890.	1880.	1870.	1860.	1850.
United States	474	485	559	572	634	626
California	340	378	504	620	716	479

In California, as in the entire country, the proportion of children rose somewhat between 1850 and 1860, but declined steadily in each succeeding decade. Conditions in California were so exceptional in 1850 that the figures for that census should be disregarded. In the forty years from 1860 to 1900, when the proportion for the United States fell from 634 to 474, or a drop of 160 in the 1,000, there was a drop of 376 in the 1,000 for California, the proportion falling from 716 to 340. Although the proportion of children to women was much greater for the Golden State than for the entire country in 1860 and 1870, this superiority no longer continues, the proportion having been less for California than for the United States at the censuses from 1880 to the one last taken.

Comparisons between this State and the whole country are best confined to figures for whites alone, since the negro population of the South has an appreciable effect upon the totals for the United States. In the table below, therefore, corresponding figures are given for merely the white population of continental United States and California:

	1900.	1890.	1880.	1870.	1860.	1850.
United States	465	473	537	562	627	613
California	338	379	513	643	764	484

The exceptional figures for 1850 being disregarded, it appears that the proportion of white children under 5 to white women 15 to 49 in California was much greater than in the United States at the censuses before 1880, but that it has been less, and increasingly so, at the censuses since then. In 1860 the proportion for the Golden State exceeded

¹ Figures drawn mainly from article on Proportion of Children, in Supplementary Analysis of Twelfth Census, Washington, D. C., 1906.

that for the whole country by 137 in the 1,000, and in 1870 by 81. In 1880, however, this had shifted to an excess of 26 in the proportion for the United States over that for California, which rose to 94 in 1890 and 127 in 1900. The excess of 137 in the proportion for California in 1860 changed to an excess of 127 in the proportion for the United States in 1900. While the proportion of white children to white women 15 to 49 years of age in the United States in 1900 was still about three fourths as great as the maximum for 1860, the proportion for California in 1900 was less than half as great as that in 1860.

The age groups employed in the early censuses made it necessary to calculate the proportion of children with respect to women 15 to 49 years of age, though 15 to 44 is usually regarded as the period of fecundity. The proportion of children under 5 to women of the usual child-bearing age, 15 to 44 years, is obtainable for each census since 1870, and the figures for the total and white population are as follows for continental United States and California, respectively:

TOTAL.	1900.	1890.	1880.	1870.
United States	518	529	609	620
California	372	414	552	661
WHITE.				
United States	508	517	586	610
California	371	415	562	687

Attention is best fixed on the proportion of white children under 5 to white women 15 to 44 years of age. In 1870 the proportion for California exceeded that for the United States by 77, but at every census thereafter the excess was on the side of the United States, the proportion exceeding that for California by 44 in 1880, 102 in 1890, and 137 in 1900. The proportion of white children to white women of child-bearing age in the country as a whole fell from 610 in 1870 to 508 in 1900, a decline of 102 or one sixth in the thirty years. The decline in the proportion for the Golden State alone, however, was much more rapid, the change being from 687 in 1870 to only 371 in 1900, a drop of 316 or nearly half in the thirty-year period.

Cities and Rural Districts.—For the decade 1890–1900 contrasts can be drawn between the proportion of children to women in cities having at least 25,000 inhabitants on one hand and smaller cities and rural districts on the other. The figures for the total and white population of continental United States and California are as follows:

	Total.		White.	
	1900.	1890.	1900.	1890.
UNITED STATES.				
Cities of 25,000	390	401	399	407
Rural districts	572	574	559	559
CALIFORNIA.				
Cities of 25,000	294	329	293	331
Rural districts	427	470	425	471

In the country as a whole the proportion of children decreased between 1890 and 1900 only in cities having at least 25,000 inhabitants,

and even there by only about one fortieth. The proportion in California, however, decreased by approximately one tenth not only for such cities as a class, but also for the rural districts outside them as well.

The following table gives corresponding figures for the principal cities of this State:

City.	Total.		White.	
	1900.	1890.	1900.	1890.
San Francisco.....	297	322	296	324
Los Angeles.....	280	352	279	354
Oakland.....	304	349	306	349
Sacramento.....	286	320	285	320

At the last census the proportion of children to women of child-bearing age was highest for Oakland, next for San Francisco and Sacramento, and lowest for Los Angeles, where also the decrease was most marked, Los Angeles having had the highest proportion at the preceding census in 1890.

The analysis may be extended further by considering the proportion of children under 5 to white women 15 to 44 distinguished as native and foreign-born. This is done by comparing the proportion of native white children having native mothers per 1,000 native white women with the proportion of native white children having foreign mothers per 1,000 foreign-born white women. The results of the calculations appear in the following table for the cities of 25,000 population and the rural districts of continental United States and California at the last two censuses:

	Native.		Foreign.	
	1900.	1890.	1900.	1890.
UNITED STATES.....	462	475	710	666
Cities of 25,000.....	296	309	612	565
Rural districts.....	522	522	841	776
CALIFORNIA.....	308	352	610	575
Cities of 25,000.....	220	241	505	485
Rural districts.....	365	414	726	678

This table shows that the proportion of children, or the apparent birth-rate, decreased in the decade only for native white women. For the United States as a whole the decrease appeared only in cities having at least 25,000 inhabitants, but for California the proportion decreased for native white women not only in the principal cities, but also outside them. The increase in the proportion of children to foreign-born white women, whether in city or country, was only slightly less marked for California than for the United States. In all cases the proportion of children to women of child-bearing age in cities of 25,000 population as a class is considerably less than in the smaller cities and rural districts grouped together.

The corresponding figures for the principal California cities are as follows:

City.	Native.		Foreign.	
	1900.	1890.	1900.	1890.
San Francisco	208	217	512	487
Los Angeles	237	313	448	455
Oakland	238	275	518	481
Sacramento	237	254	548	546

The proportion of children to native white women was lowest at each census for San Francisco, where, however, there was only a slight decrease between 1890 and 1900. The proportion was about the same in 1900 for each of the three remaining cities, though the decrease in the decade was greatest for Los Angeles and least for Sacramento. Los Angeles is also the only one of the four cities of 25,000 population in California to show any decrease in the proportion of children to foreign-born white women. This proportion increased most in 1890-1900 in Oakland and next in San Francisco. Though there was only a slight increase for Sacramento, the State capital has the distinction of being the city where the proportion of children to foreign women was decidedly highest at each census.

Children to Married Women.—The closest approximation to a birth-rate obtainable from the Federal Census is found by comparing the children under 5 with the married women of child-bearing age, 15 to 44 years. The proportions for the total and white population respectively are shown herewith as far as the published data permit the calculations to be carried:

	Total.		White.	
	1900.	1890.	1900.	1890.
UNITED STATES	929	957	908	934
Cities of 100,000	773	811	787	822
Rest of country	967	985	941	958
CALIFORNIA	692	764	692	768
Cities of 100,000	582	655	582	662
San Francisco	598	655	599	662
Los Angeles	534	---	532	---
Rest of State	743	801	743	804

In the United States as a whole, the proportion of children to married women of child-bearing age decreased considerably more in 1890-1900 for cities having at least 100,000 inhabitants than for the rest of the country, but in California the decrease in the decade was only slightly more for such cities as a class than for all the rest of the State. The rise of Los Angeles above the 100,000 limit of population between 1890 and 1900 had the effect of reducing the proportion of children to married women for this class of cities in California, as the proportion was much lower in 1900 for Los Angeles than for San Francisco. In California as in the United States the proportion of children to married women is very much less in cities of 100,000 population than outside them.

Corresponding proportions may also be calculated for married white women distinguished as native and foreign-born, as follows:

	Native.		Foreign.	
	1900.	1890.	1900.	1890.
UNITED STATES	862	894	1,058	1,024
Cities of 100,000	643	691	963	934
Rest of country	902	923	1,128	1,075
CALIFORNIA	618	708	891	861
Cities of 100,000	477	533	780	772
San Francisco	478	533	795	772
Los Angeles	476	---	709	---
Rest of State	674	750	969	916

The table shows that the proportion of children to native white married women decreased in 1890-1900 both for the Golden State and the entire nation, and that while the decrease for the United States was most marked in cities of 100,000 population, that for California was most marked outside them. On the other hand, the proportion of children to foreign-born white married women increased appreciably in the decade, the increase for both State and nation being particularly great outside cities of 100,000 population, especially in California.

Conclusion.—The conclusions drawn from the statistics of the Federal Census may now be summarized. Although the proportion of children under 5 to women 15 to 49 in California was above the average for the United States in 1860 and 1870, it fell somewhat below the general average in 1880 and was still further below in 1890 and 1900. While the number of children per 1,000 white women of the age specified decreased by one fourth for the United States in the forty years, 1860-1900, it decreased by about half for California. Similarly in the thirty-year period, 1870-1900, when the proportion of children to white women 15 to 44 years old declined by one sixth for the entire country, it declined by nearly half for this State alone. The decrease in the proportion of children, or the fall in the approximate birth-rate, in the decade 1890-1900 was confined to cities of 25,000 population in the United States as a whole, but in California appeared also among the inhabitants of rural districts outside such cities. The proportion is invariably less in cities of 25,000 population as a class than in smaller cities and rural districts grouped together. The fall in the birth-rate is limited to native white women, both in State and nation and in cities and rural districts. Increases appear in the proportion of children to foreign-born white women, and the increases in California, whether for city or country, are almost as great as for the whole United States. Generally speaking, the proportion of children has fallen not only with respect to all women of child-bearing age, but also in comparison with merely the married women of this age. The decrease appears both in cities of 100,000 population and outside them, whether for State or nation, but as before is limited to native white married women, the proportion of children to the married as to all foreign-born white women having increased in the decade 1890-1900. The decrease in the proportion of children to native white married women in the United States

was mainly in cities of 100,000 population, but in California was somewhat more marked outside than within such cities. The increase in the proportion for married women of foreign birth, for both State and nation, was particularly great outside cities of 100,000 population, the relative increase being even greater for California than for the United States.

Of the principal cities in the Golden State, Oakland, in 1900, had the highest proportion of children to women of child-bearing age, San Francisco and Sacramento the next highest, and Los Angeles the lowest. Los Angeles, however, had the highest proportion in 1890, the decrease for this city in the decade having been very rapid. The proportion of children to native white women was lowest both in 1900 and 1890 for San Francisco, and at the last census was not far from the same for each of the three remaining cities. Los Angeles alone shows a decrease in the proportion of children per 1,000 foreign-born white women. This proportion increased most between 1890 and 1900 in Oakland and next in San Francisco, but nevertheless was decidedly highest at each census in Sacramento. The proportion of children under 5 to married women 15 to 44, whether native or foreign born, was less for Los Angeles than for San Francisco in 1900.

The relatively low and decreasing proportion of children to women of child-bearing age shown for Los Angeles suggests a partial explanation for the fact that the proportion for California has fallen even more rapidly than that for the United States. The population of California, instead of growing only by excess of births over deaths, increases largely by adult migration from Eastern states and foreign countries. The arrival in the State of many adults seldom accompanied by young children adds greatly to the number of potential mothers without making any corresponding increase in the number of children recently born, and so tends to depress the apparent birth-rate as measured roughly by the proportion of children under 5 years old to women of child-bearing age. As the center for much migration of this kind from Eastern states, Los Angeles shows a particularly marked decrease in the proportion of children.

However, even if allowance were made for the influence of the factor mentioned, the figures would still probably show that the proportion of children to women has declined in the Golden State no less than in the entire country because of an actual decrease in the birth-rate. Though "race suicide" does not prevail in the foreign-born white population of either California or the United States, it evidently exists to some extent in the native white population living here as elsewhere. Whether the birth-rate, or the proportion of children, is higher or lower for California-born women than for other natives of the United States can not be determined from the present figures of the Federal Census, but only from a future analysis of statistical data obtained in the registration of births as now required by the State law.

STATISTICS OF MARRIAGES: 1905-1906.

Summary.—Altogether 17,932 marriages were reported to the California State Bureau of Vital Statistics in 1905-1906, the first year covered by the new law requiring marriages to be registered.

San Francisco reported 4,230 marriages, or 23.6 per cent of the State total, despite the loss of records in April, 1906.

There were also over 2,000 marriages for the year in Los Angeles and Alameda counties; between 600 and 1,000 in Santa Clara, Sacramento, and Marin; and between 400 and 500 in Fresno, San Diego, San Joaquin, San Bernardino, and Orange.

For an estimated State population of 1,784,521 in 1905 the 17,932 marriages in 1905-1906 give a rate of 10.0 per 1,000 population, though complete returns from Los Angeles county for the year would make the State rate 11.1 instead.

The marriage-rate is higher for the seven counties of Southern California than for the fifty north of Tehachapi. The rate is also higher for the metropolitan area, comprising San Francisco and the other bay counties, than for the rural counties of Northern and Central California.

Among the individual counties, Marin shows the highest marriage-rate, 36.4 per 1,000 population, followed by Orange 18.5, San Mateo 17.9, Sacramento 17.0, and Los Angeles 15.6 (corrected rate). The marriage-rates are also above the State average, 10.0, for the following counties: San Bernardino, Santa Clara, Alameda, Riverside, San Diego, San Joaquin, Fresno, Tulare, Santa Barbara, Stanislaus, and San Luis Obispo.

The statistics indicate that there is a decided tendency for persons living in rural counties to be married at the largest city easily accessible. This seems the readiest explanation of the relatively high marriage-rates not only for the metropolitan area in Northern and Southern California and for Los Angeles county in Southern California, but also for the counties containing such cities as Sacramento, San José, Stockton, Fresno, Visalia, Modesto, and San Luis Obispo.

There is also a counter movement by which residents of very large cities, like San Francisco or Los Angeles, prefer to be married in suburban counties. Thus it happens that the marriage-rates are much higher for Marin, San Mateo, and Alameda counties than for the metropolis itself, and that in Southern California the rate is highest for Orange rather than for Los Angeles county. This movement is particularly marked on San Francisco Bay, where San Rafael, in Marin county, is a veritable Gretna Green, especially, as shown later, for divorcees.

In 13,182 of the 17,932 marriages in 1905-1906, or 73.5 per cent of all cases, the marriage was the first for both parties. The per cent of first marriages is highest, 76.8, for the coast counties of Northern California, followed by 76.2 for the interior counties of Central California and 76.0 for San Francisco.

While 1,958 single men were married to widowed or divorced women, only 1,450 single women were married to widowed or divorced men. In fact, only nine of the fifty-seven counties show exceptions to the

rule that there are more unions of bachelors with widows than of maids with widowers.

In 1,342 instances, or 7.5 per cent of all, the marriage was the second or over of both parties. The per cent of marriages where both parties had been married before is particularly high for Southern California, especially outside Los Angeles, and for the bay counties other than San Francisco. Though among the eight minor geographic divisions, San Francisco has the lowest per cent of such marriages, yet the per cent is somewhat higher for the metropolitan area than for the rural counties of Northern and Central California.

Altogether 15,140 or 84.4 per cent of the grooms were single, 1,655 widowed, and 1,137 divorced; while of the brides 14,632 or 81.6 per cent were single, 1,891 widowed, and 1,409 divorced. The widows outnumber the widowers by 236 or 14.3 per cent, and among the divorced the women exceed the men by 272 or 23.9 per cent.

The per cent of widowers is particularly high only in Southern California, especially outside Los Angeles, but the per cent of widows is relatively high, not only in Southern California, but also in both the coast and interior counties of Northern California.

The per cent divorced, both among grooms and brides, is highest for the bay counties other than San Francisco, and next for Southern California, especially outside Los Angeles, being highest south of Tehachapi in Orange county.

Though the per cent of divorced brides is 7.9 for all California and only 7.4 for San Francisco, it is 8.9 for Alameda, 9.0 for Contra Costa, 14.1 for San Mateo, and 15.5 for Marin. It appears, therefore, that the tendency for residents of the metropolis to be married in suburban counties is particularly strong among divorcees.

County Totals.—Under the law of 1905 requiring County Recorders as local registrars to transmit to the State Registrar the original marriage certificates filed with them each month, 17,932 marriages were registered in the California State Bureau of Vital Statistics for 1905–1906. The total for the last half of 1905 was 8,338, against 9,594 for the first half of 1906.

Table 1, below, shows the counties for which at least 100 marriages were reported to the State Bureau of Vital Statistics in 1905–1906:

TABLE 1.—*Rank of Counties with at Least 100 Marriages: 1905–1906.*

Rank. County.	Marriages: 1905–1906.	Rank. County.	Marriages: 1905–1906.
THE STATE.....	17,932	17. Tulare	205
1. San Francisco	4,230	18. Mendocino	181
2. Los Angeles.....	*2,241	19. San Luis Obispo.....	179
3. Alameda	2,221	20. Humboldt.....	170
4. Santa Clara	921	21. Napa.....	159
5. Sacramento	826	22. Solano	158
6. Marin	619	23. Contra Costa	155
7. Fresno	491	24. Monterey	153
8. San Diego	480	25. Kern	140
9. San Joaquin	456	26. Ventura	137
10. San Bernardino	453	27. Shasta	132
11. Orange	421	28. Nevada	118
12. Riverside	266	29. Kings	112
13. Sonoma	237	30. Siskiyou	111
14. San Mateo	235	31. Stanislaus.....	104
15. Santa Barbara	226	32. Butte	103
16. Santa Cruz	225	Remaining 25 counties.....	1,067

*Returns incomplete.

Despite the destruction of certificates for more than one half of April, 1906, and incomplete registration in the confusion following the great fire, San Francisco with 4,230 marriages properly registered contributes 23.6 per cent of the State total. The returns for Los Angeles cover little over half a year, the first certificates received having been for December, 1905. Complete returns for the whole twelve months would have made the total for Los Angeles county nearer that for San Francisco. In Alameda county, as well as San Francisco and Los Angeles, over 2,000 marriages were registered in 1905-1906.

With regard to the number of marriages registered, the counties fall into several groups. First, there is a group of 3 counties, each with over 2,000 marriages in the year; next comes another group of 3 counties, each with between 600 and 1,000 marriages in the year; then a group of 5, each with from 400 to 500 marriages; then a group of 6, with from 200 to 300 marriages; and then a group of 15 with from 100 to 200 marriages.

In addition to the 32 counties ranked in Table 1, there were 9 with from 50 to 100 marriages in the year, viz.: Amador, Calaveras, El Dorado, Merced, San Benito, Tehama, Tuolumne, Yolo, and Yuba; 10 with from 25 to 50 marriages, viz.: Colusa, Glenn, Inyo, Lake, Lassen, Madera, Modoc, Placer, Plumas, and Sutter; and 6 with less than 25 marriages each, viz.: Alpine, Del Norte, Mariposa, Mono, Sierra, and Trinity.

Marriage-rates.—For the purpose of calculating marriage-rates, the population of California in 1905 has been estimated conservatively according to the Census Bureau method by adding to the population in 1900 five tenths of the increase between 1890 and 1900, except that for the few counties showing decreases between the last two Federal censuses the population in 1900 has been taken for 1905, and for the three principal cities arbitrary estimates have been made because of their exceptionally rapid growth. The estimate for San Francisco in 1905 is 450,000, for Los Angeles, 180,000, and for Oakland, 90,000. As a bulk of the marriage returns for 1905-1906 were not affected by the public calamity in April, 1906, no estimates have been changed on account of temporary readjustments of population caused by the San Francisco fire. For convenience in tabulation, the fifty-seven counties of California have been grouped in three main and eight minor geographic divisions, which appear in Table 2, the counties in each group being arranged alphabetically for the sake of ready reference. Marriage-rates are also shown for the metropolitan area, comprising San Francisco and the other bay counties (Alameda, Contra Costa, Marin, and San Mateo) in contrast with the rural counties of Northern and Central California.

TABLE 2.—*Estimated Population (1905), Marriages, and Marriage-rate per 1,000 Population, for Counties arranged Geographically: 1905-1906.*

County.	Estimated Population: 1905.	Marriages: 1905-1906.	Marriage- rate per 1,000 Population.
THE STATE.....	1,784,521	17,932	*10.0
<i>Northern California</i>	269,510	1,693	6.3
Coast counties.....	121,785	806	6.6
Del Norte.....	2,408	15	6.2
Humboldt.....	28,922	170	5.9
Lake.....	6,017	32	5.3
Mendocino.....	21,892	181	8.3
Napa.....	16,471	159	9.7
Sonoma.....	41,360	237	5.7
Trinity.....	4,715	12	2.5
Interior counties.....	147,725	887	6.0
Butte.....	17,117	103	6.0
Colusa.....	7,364	38	5.2
Glenn.....	5,150	35	6.8
Lassen.....	4,647	30	6.5
Modoc.....	5,121	44	8.6
Nevada.....	17,999	118	6.6
Placer.....	16,129	41	2.5
Plumas.....	4,657	30	6.4
Shasta.....	19,911	132	6.6
Sierra.....	4,017	16	4.0
Siskiyou.....	19,362	111	5.7
Sutter.....	6,095	35	5.7
Tehama.....	11,536	81	7.0
Yuba.....	8,620	73	8.5
<i>Central California:</i>	1,105,090	12,015	10.9
San Francisco.....	450,000	4,230	9.4
Other bay counties.....	216,127	3,230	14.9
Alameda.....	165,700	2,221	13.4
Contra Costa.....	20,312	155	7.6
Marin.....	17,017	619	36.4
San Mateo.....	13,098	235	17.9
Coast counties.....	132,371	1,544	11.7
Monterey.....	19,752	153	7.7
San Benito.....	6,744	66	9.8
San Luis Obispo.....	16,920	179	10.6
Santa Clara.....	66,322	921	13.9
Santa Cruz.....	22,633	225	9.9
Interior counties.....	306,592	3,011	9.8
Alpine.....	509	1	2.0
Amador.....	11,514	56	4.9
Calaveras.....	12,359	51	4.1
El Dorado.....	8,986	56	6.2
Fresno.....	43,079	491	11.4
Inyo.....	4,794	30	6.3
Kern.....	19,816	140	7.1
Kings.....	12,044	112	9.3
Madera.....	7,247	40	5.5
Mariposa.....	5,187	11	2.1
Merced.....	9,780	75	7.7
Mono.....	2,250	5	2.2
Sacramento.....	48,703	826	17.0
San Joaquin.....	38,864	456	11.7
Solano.....	25,742	158	6.1
Stanislaus.....	9,550	104	10.9
Tulare.....	18,375	205	11.2
Tuolumne.....	13,708	99	7.2
Yolo.....	14,085	95	6.7

TABLE 2.—*Estimated Population (1905), Marriages, and Marriage-rate per 1,000 Population for Counties arranged Geographically: 1905-1906—Continued.*

County.	Estimated Population: 1905.	Marriages: 1905-1906.	Marriage- rate per 1,000 Population.
<i>Southern California</i>	409,921	4,224	*10.3
Los Angeles	259,000	2,241	*8.7
Other counties	150,921	1,983	13.1
Orange	22,750	421	18.5
Riverside	20,140	266	13.2
San Bernardino	31,441	453	14.4
San Diego	39,551	480	12.1
Santa Barbara	20,524	226	11.0
Ventura	16,515	137	8.3
<i>Northern and Central California</i>	1,374,600	13,708	10.0
Coast counties	920,283	9,810	10.7
Interior counties	454,317	3,898	8.6
Metropolitan area	666,127	7,460	11.2
Rural counties	708,473	6,248	8.8

* The 2,241 marriages for Los Angeles County include only 191 for 1905, against 2,050 for 1906, so that the registration is short by 1,800 or more. Corrected for this omission, the rate would be 11.1 for the State, 14.7 for Southern California, and 15.6 for Los Angeles.

It appears from Table 2 that for an estimated State population of 1,784,521 in 1905, the 17,932 marriages registered in 1905-1906 give a marriage-rate of 10.0 per 1,000 population, though complete returns for Los Angeles county would make the State rate 11.1 instead. The marriage-rate is higher for Southern California than for Northern and Central California together. In Northern as well as Central California the rate is higher for the coast counties than for the interior counties. The rate is also considerably higher for the metropolitan area, comprising San Francisco and the other bay counties, than for the rural counties north of Tehachapi.

Among the individual counties, Marin shows the highest marriage-rate, 36.4 per 1,000 population, followed by Orange 18.5, San Mateo 17.9, and Sacramento 17.0. The corrected rate for Los Angeles county, 15.6, would place it next in rank, followed by San Bernardino 14.4, Santa Clara 13.9, Alameda 13.4, Riverside, 13.2, San Diego 12.1, San Joaquin 11.7, Fresno, 11.4, Tulare 11.2, Santa Barbara 11.0, Stanislaus, 10.9, and San Luis Obispo 10.6, these being the counties with marriage-rates above the State average.

The fact that the marriage-rate is higher for the metropolitan area than for the rural counties of Northern and Central California and that the corrected rate for Los Angeles is above that for the rest of Southern California, indicates that marriages usually take place at urban centers. Moreover, the counties named as having marriage-rates above the State average will be readily recognized as counties having large cities. As a rule, too, in each geographic division the counties with rates above the average for the group are counties with important cities or towns. It seems, therefore, that there is a decided tendency for those about to marry to slip away from their homes in rural counties to be married at an important city in some other county.

At the same time there is a counter movement by which couples residing in great cities like San Francisco and Los Angeles go to a suburban county when they wish to be married. This counter movement is shown by the fact that at San Francisco bay the marriage-rates are much higher for Marin, San Mateo, and Alameda counties than for the metropolis itself, and in Southern California the marriage-rate for Orange county is considerably higher even than the corrected rate for Los Angeles.

Number in Order.—Table 3, below, gives the number in order of marriages, with per cents, for the three main and eight minor geographic divisions, including certain other groups of counties.

TABLE 3.—*Marriages classified by Number in Order, with Per Cent Distributions, for Geographic Divisions: 1905-1906.*

Geographic Division.	Total Marriages.	Number of Marriage.				Per Cent of Marriages.			
		1st of Both Parties.	1st of Groom Only.	1st of Bride Only.	2d or Over of Both.	1st of Both Parties.	1st of Groom Only.	1st of Bride Only.	2d or Over of Both.
THE STATE.....	17,932	13,182	1,958	1,450	1,342	73.5	10.9	8.1	7.5
<i>Northern California</i>	1,693	1,278	194	110	111	75.5	11.5	6.5	6.5
Coast counties.....	806	619	89	49	49	76.8	11.0	6.1	6.1
Interior counties.....	887	659	105	61	62	74.3	11.8	6.9	7.0
<i>Central California</i>	12,015	8,900	1,331	933	851	74.1	11.1	7.7	7.1
San Francisco.....	4,230	3,217	456	312	245	76.0	10.8	7.4	5.8
Other bay counties.....	3,230	2,241	415	282	292	69.4	12.9	8.7	9.0
Coast counties.....	1,544	1,147	145	141	111	74.3	9.4	9.1	7.2
Interior counties.....	3,011	2,295	315	198	203	76.2	10.5	6.6	6.7
<i>Southern California</i>	4,224	3,004	433	407	380	71.1	10.3	9.6	9.0
Los Angeles.....	2,241	1,630	216	205	190	72.7	9.6	9.2	8.5
Other counties.....	1,983	1,374	217	202	190	69.3	10.9	10.2	9.6
<i>Northern and Central California</i>	13,708	10,178	1,525	1,043	962	74.3	11.1	7.6	7.0
Coast counties.....	9,810	7,224	1,105	784	697	73.6	11.3	8.0	7.1
Interior counties.....	3,898	2,954	420	259	265	75.8	10.8	6.6	6.8
Metropolitan area.....	7,460	5,458	871	594	537	73.1	11.7	8.0	7.2
Rural counties.....	6,248	4,720	654	449	425	75.5	10.5	7.2	6.8

Of the 17,932 marriages registered in 1905-1906, 13,182 or 73.5 per cent were first marriages for both parties, neither groom nor bride having ever been married before. The per cent of marriages with both parties single is highest for the coast counties of Northern California, 76.8, the interior counties of Central California, 76.2, and for San Francisco, 76.0. It is lowest, 69.3, for Southern California outside Los Angeles, and next lowest, 69.4, for the bay counties other than San Francisco. The per cent of marriages where neither party was married before is higher for Northern and Central California than for Southern California and north of Tehachapi is higher for the rural counties than for the metropolitan area.

In 1,958 cases, or 10.9 per cent of all, the marriage was the first of the groom only, and in 1,450 cases, or 8.1 per cent, it was the first of the bride only. As a rule, the number of single men marrying widowed or

divorced women is greater than the number of single women marrying widowed or divorced men. No geographical division shows a variation from this rule, and exceptions to the rule appear for only nine counties. Plumas, Siskiyou, Monterey, San Benito, San Luis Obispo, Santa Cruz, Kings, Riverside, and Santa Barbara.

In no more than 1,342 instances, or 7.5 per cent of the total number, was the marriage the second or over of both the groom and the bride, each party having been married once or more before. The per cent of marriages where both parties had been previously married is highest, 9.6, for the six counties of Southern California other than Los Angeles, followed by 9.0 for the bay counties other than San Francisco and by 8.5 for Los Angeles. The per cent of marriages where neither party was single is lowest of all, 5.8, for San Francisco, next, 6.1, for the coast counties of Northern California, and next, 6.7, for the interior counties of Central California. The per cent of such marriages is somewhat higher for the metropolitan area than for the rural counties of Northern and Central California, being 7.2 for the former, against 6.8 for the latter.

Status of Parties.—Table 4 shows for each geographic division the civil status or marital condition of both grooms and brides—whether single, widowed, or divorced—at the time of marriage.

TABLE 4.—*Grooms and Brides classified by Marital Condition, with Per Cent Distributions, for Geographic Divisions: 1905-1906.*

Geographic Division.	Totals.	Grooms.			Brides.		
		Single.	Widow'd	Divorced.	Single.	Widow'd.	Divorced.
NUMBERS.							
THE STATE	17,932	15,140	1,655	1,137	14,632	1,891	1,409
Northern California	1,693	1,472	156	65	1,388	203	102
Coast counties	806	708	71	27	668	96	42
Interior counties	887	764	85	38	720	107	60
Central California	12,015	10,231	1,001	783	9,833	1,194	988
San Francisco	4,230	3,673	311	246	3,529	388	313
Other bay counties	3,230	2,656	304	270	2,523	366	341
Coast counties	1,544	1,292	144	108	1,288	138	118
Interior counties	3,011	2,610	242	159	2,493	302	216
Southern California	4,224	3,437	498	289	3,411	494	319
Los Angeles	2,241	1,846	240	155	1,835	246	160
Other counties	1,983	1,591	258	134	1,576	248	159
Northern and Central California	13,708	11,703	1,157	848	11,221	1,397	1,090
Coast counties	9,810	8,329	830	651	8,008	988	814
Interior counties	3,898	3,374	327	197	3,213	409	276
Metropolitan area	7,460	6,329	615	516	6,052	754	654
Rural counties	6,248	5,374	542	332	5,169	643	436

TABLE 4.—*Grooms and Brides classified by Marital Condition, with Per Cent Distributions, for Geographic Divisions: 1905-1906—Continued.*

Geographic Division.	Totals.	Grooms.			Brides.		
		Single.	Widow'd	Divorced.	Single.	Widow'd	Divorced.
PER CENTS.							
THE STATE	100.0	84.4	9.2	6.4	81.6	10.5	7.9
Northern California	100.0	87.0	9.2	3.8	82.0	12.0	6.0
Coast counties	100.0	87.8	8.8	3.4	82.9	11.9	5.2
Interior counties	100.0	86.1	9.6	4.3	81.2	12.0	6.8
Central California	100.0	85.4	8.3	6.5	81.8	10.0	8.2
San Francisco	100.0	86.8	7.4	5.8	83.4	9.2	7.4
Other bay counties	100.0	82.2	9.4	8.4	78.1	11.3	10.6
Coast counties	100.0	83.7	9.3	7.0	83.4	8.9	7.7
Interior counties	100.0	86.7	8.0	5.3	82.8	10.0	7.2
Southern California	100.0	81.4	11.8	6.8	80.7	11.7	7.6
Los Angeles	100.0	82.4	10.7	6.9	81.9	11.0	7.1
Other counties	100.0	80.2	13.0	6.8	79.5	12.5	8.0
Northern and Central Cali- fornia	100.0	85.4	8.4	6.2	81.9	10.2	7.9
Coast counties	100.0	84.9	8.5	6.6	81.6	10.1	8.3
Interior counties	100.0	86.6	8.4	5.0	82.4	10.5	7.1
Metropolitan area	100.0	84.8	8.3	6.9	81.1	10.1	8.8
Rural counties	100.0	86.0	8.7	5.3	82.7	10.3	7.0

It appears from Table 4 that 15,140 or 84.4 per cent of the grooms were single, 1,655 or 9.2 per cent were widowed, and 1,137 or 6.4 per cent were divorced. Among the brides the single numbered 14,632 or 81.6 per cent, the widowed 1,891 or 10.5 per cent, and the divorced 1,409 or 7.9 per cent. The widows outnumber the widowers by 236 or 14.3 per cent, and the number of divorced women exceeds that of divorced men by 272 or 23.9 per cent.

The per cent of widowers is particularly high (11.8) in Southern California, being 10.7 for Los Angeles and 13.0 for the other six counties. The per cent of widows is also highest (12.5) for the six counties of Southern California other than Los Angeles, and is next highest, 12.0 and 11.9 respectively, for the interior and coast counties of Northern California.

The per cent divorced, both among grooms and brides, is highest for the bay counties other than San Francisco, and next for Southern California, especially outside Los Angeles. While the per cent of divorced grooms is only 6.4 for the State, it is 8.4 for the four counties adjoining San Francisco, 6.9 for Los Angeles and 6.8 for the other six counties of Southern California, being 8.3 for Orange county. Similarly, as compared with 7.9 for the State, the per cent of divorced brides is 10.6 for the four counties suburban to San Francisco, and 8.0 for the six counties of Southern California other than Los Angeles, being 10.0 for Orange against 7.1 for Los Angeles. Though the per cent of divorced brides is only 7.4 for San Francisco, it is 8.9 for Alameda, 9.0 for Contra Costa, 14.1 for San Mateo, and 15.5 for Marin. But as heretofore explained, residents of the metropolis often prefer to be married in the suburbs and this seems to be especially the case among divorced persons.

TABLE 5.—*Marriages classified by Number in Order and Marital Condition of Parties.*

County.	Total Marriages.	Number of Marriage.				Groom.		
		1st of Both Parties.	1st of Gro'm Only.	1st of Bride Only.	2d or Over of Both.	Single.	Wid-owed.	Divorced.
THE STATE	17,932	13,182	1,958	1,450	1,342	15,140	1,655	1,137
Northern California	1,693	1,278	194	110	111	1,472	156	65
Coast counties	806	619	89	49	49	708	71	27
Del Norte	15	12	2	1	1	14	1	1
Humboldt	170	136	18	10	6	154	12	4
Lake	32	27	1	1	3	28	3	1
Mendocino	181	134	22	13	12	156	20	5
Napa	159	114	21	10	14	135	15	9
Sonoma	237	186	23	14	14	209	20	8
Trinity	12	10	2	1	1	12	1	1
Interior counties	887	659	105	61	62	764	85	38
Butte	103	75	14	8	6	89	8	6
Colusa	38	30	3	3	2	33	2	3
Glenn	35	25	6	1	3	31	3	1
Lassen	30	20	4	3	3	24	5	1
Modoc	44	38	5	1	1	43	1	1
Nevada	118	82	18	7	11	100	11	7
Placer	41	30	6	2	3	36	1	4
Plumas	30	26	1	2	1	27	3	1
Shasta	132	87	20	11	14	107	16	9
Sierra	16	13	2	1	1	15	1	1
Siskiyou	111	84	8	9	10	92	15	4
Sutter	35	28	5	2	1	33	2	1
Tehama	81	64	8	7	2	72	8	1
Yuba	73	57	5	4	7	62	10	1
Central California	12,015	8,900	1,331	983	851	10,231	1,001	783
San Francisco	4,230	3,217	456	312	245	3,673	311	246
Other bay counties	3,230	2,241	415	282	292	2,656	304	270
Alameda	2,221	1,611	238	179	193	1,849	210	162
Contra Costa	155	110	22	12	11	132	16	7
Marin	619	368	116	66	69	484	55	80
San Mateo	235	152	39	25	19	191	23	21
Coast counties	1,544	1,147	145	141	111	1,292	144	108
Monterey	153	110	14	20	9	124	14	15
San Benito	66	56	3	4	3	59	5	2
San Luis Obispo	179	140	14	18	7	154	17	8
Santa Clara	921	681	95	76	69	776	83	62
Santa Cruz	225	160	19	23	23	179	25	21

with Per Cents Distributions, for Counties arranged Geographically: 1905-1906.

Bride.			Per Cent of Marriages.				Per Cent of Grooms.			Per Cent of Brides.		
Single.	Wid- owed.	Di- vorce'd.	1st of Both Par- ties.	1st of Gro'm Only.	1st of Bride Only.	2d or Over of Both.	Single.	Wid- owed.	Di- vorce'd	Single	Wid- owed.	Di- vorce'd
14,632	1,891	1,409	73.5	10.9	8.1	7.5	84.4	9.2	6.4	81.6	10.5	7.9
1,388	203	102	75.5	11.5	6.5	6.5	87.0	9.2	3.8	82.0	12.0	6.0
668	96	42	76.8	11.0	6.1	6.1	87.8	8.8	3.4	82.9	11.9	5.2
13	1	1	80.0	13.3	6.7	-----	93.3	6.7	-----	86.6	6.7	6.7
146	17	7	80.0	10.6	5.9	3.5	90.6	7.1	2.3	85.9	10.0	4.1
28	3	1	84.4	3.1	3.1	9.4	87.5	9.4	3.1	87.5	9.4	3.1
147	24	10	74.0	12.2	7.2	6.6	86.2	11.0	2.8	81.2	13.3	5.5
124	26	9	71.7	13.2	6.3	8.8	84.9	9.4	5.7	78.0	16.3	5.7
200	24	13	78.5	9.7	5.9	5.9	88.2	8.4	3.4	84.4	10.1	5.5
10	1	1	83.3	16.7	-----	-----	100.0	-----	-----	83.4	8.3	8.3
720	107	60	74.3	11.8	6.9	7.0	86.1	9.6	4.3	81.2	12.0	6.8
83	13	7	72.8	13.6	7.8	5.8	86.4	7.8	5.8	80.6	12.6	6.8
33	4	1	78.9	7.9	7.9	5.3	86.8	5.3	7.9	86.8	10.5	2.7
26	6	3	71.4	17.1	2.9	8.6	88.5	8.6	2.9	74.3	17.1	8.6
23	6	1	66.7	13.3	10.0	10.0	80.0	16.7	3.3	76.7	20.0	3.3
39	4	1	86.3	11.4	2.3	-----	97.7	2.3	-----	88.6	9.1	2.3
89	19	10	69.5	15.3	5.9	9.3	84.8	9.3	5.9	75.4	16.1	8.5
32	6	3	73.2	14.6	4.9	7.3	87.8	2.4	9.8	78.1	14.6	7.3
28	2	-----	86.7	3.3	6.7	3.3	90.0	10.0	-----	93.3	6.7	-----
98	19	15	65.9	15.7	8.3	10.6	81.1	12.1	6.8	74.2	14.4	11.4
14	1	1	81.3	12.5	6.2	-----	93.8	6.2	-----	87.5	6.3	6.2
93	9	9	75.7	7.2	8.1	9.0	82.9	13.5	3.6	83.8	8.1	8.1
30	1	4	80.0	14.3	5.7	-----	94.3	5.7	-----	85.7	2.9	11.4
71	7	3	79.0	9.9	8.6	2.5	88.9	9.9	1.2	87.7	8.6	3.7
61	10	2	78.1	6.8	5.5	9.6	84.9	13.7	1.4	83.6	13.7	2.7
9,833	1,194	988	74.1	11.1	7.7	7.1	85.4	8.3	6.5	81.8	10.0	8.2
3,529	388	313	76.0	10.8	7.4	5.8	86.8	7.4	5.8	83.4	9.2	7.4
2,523	366	341	69.4	12.9	8.7	9.0	82.2	9.4	8.4	78.1	11.3	10.6
1,790	233	198	72.5	10.7	8.1	8.7	83.2	9.5	7.3	80.6	10.5	8.9
122	19	14	71.0	14.2	7.7	7.1	85.2	10.3	4.5	78.7	12.3	9.0
434	89	96	59.5	18.7	10.7	11.1	78.2	8.9	12.9	70.1	14.4	15.5
177	25	33	64.7	16.6	10.6	8.1	81.3	9.8	8.9	75.3	10.6	14.1
1,288	138	118	74.3	9.4	9.1	7.2	83.7	9.3	7.0	83.4	8.9	7.7
130	11	12	71.9	9.1	13.1	5.9	81.1	9.1	9.8	85.0	7.2	7.8
60	2	4	84.9	4.5	6.1	4.5	89.4	7.6	3.0	90.9	3.0	6.1
158	15	6	78.2	7.8	10.1	3.9	86.0	9.5	4.5	88.3	8.4	3.3
757	89	75	73.9	10.3	8.3	7.5	84.3	9.0	6.7	82.2	9.7	8.1
183	21	21	71.1	8.5	10.2	10.2	79.6	11.1	9.3	81.4	9.3	9.3

TABLE 5.—Marriages classified by Number in Order and Marital Condition of Parties.

County.	Total Mar- riages.	Number of Marriage.				Groom.		
		1st of Both Parties.	1st of Gro'm Only.	1st of Bride Only.	2d or Over of Both.	Single.	Wid- owed.	Di- vorc'd
<i>Central California—Continued.</i>								
Interior counties	3,011	2,295	315	198	203	2,610	242	159
Alpine	1	1				1		
Amador	56	44	8	3	1	52	4	
Calaveras	51	42	4	3	2	46	2	3
El Dorado	56	54	1	1		55	1	
Fresno	491	390	38	31	32	428	46	17
Inyo	30	28	1	1		29	1	
Kern	140	95	26	10	9	121	10	9
Kings	112	95	4	8	5	99	9	4
Madera	40	35	3	1	1	38	1	1
Mariposa	11	11				11		
Merced	75	60	9	3	3	69	4	2
Mono	5	5				5		
Sacramento	826	585	108	63	70	693	71	62
San Joaquin	456	325	52	43	36	377	43	36
Solano	158	122	15	9	12	137	14	7
Stanislaus	104	84	8	6	6	92	8	4
Tulare	205	165	17	10	13	182	15	8
Tuolumne	99	77	11	4	7	88	8	3
Yolo	95	77	10	2	6	87	5	3
<i>Southern California</i>								
Los Angeles	4,224	3,004	433	407	380	3,437	498	289
Other counties	2,241	1,630	216	205	190	1,846	240	155
Orange	1,983	1,374	217	202	190	1,591	258	134
Riverside	421	284	46	39	52	330	56	35
San Bernardino	266	193	24	25	24	217	32	17
San Diego	453	339	42	40	32	381	51	21
Santa Barbara	480	307	61	61	51	368	75	37
Ventura	226	147	29	30	20	176	35	15
.....	137	104	15	7	11	119	9	9
<i>Northern and Central California..</i>								
Coast counties	13,708	10,178	1,525	1,043	962	11,703	1,157	848
Interior counties	9,810	7,224	1,105	784	697	8,329	830	651
Metropolitan area	3,898	2,954	420	259	265	3,374	327	197
Rural counties	7,460	5,458	871	594	537	6,329	615	516
.....	6,248	4,120	654	449	425	5,374	542	332

with Per Cents Distributions, for Counties arranged Geographically: 1905-1906—Continued.

Bride:			Per Cent of Marriages.				Per Cent of Grooms.			Per Cent of Brides.		
Single.	Wid- owed.	Di- vorc'd.	1st of Both Par- ties.	1st of Gro'm Only.	1st of Bride Only.	2d or Over of Both.	Single.	Wid- owed.	Di- vorc'd	Single	Wid- owed.	Di- vorc'd
2,493	302	216	78.2	10.5	6.6	6.7	86.7	8.0	5.3	82.8	10.0	7.2
1			100.0				100.0			100.0		
47	7	2	78.6	14.3	5.3	1.8	92.9	7.1		83.9	12.5	3.6
45	1	5	82.4	7.8	5.9	3.9	90.2	3.9	5.9	88.2	2.0	9.8
55		1	96.4	1.8	1.8		98.2	1.8		98.2		1.8
421	50	20	79.4	7.8	6.3	6.5	87.2	9.4	3.4	85.7	10.2	4.1
29	1		93.4	3.3	3.3		96.7	3.3		96.7	3.3	
105	22	13	87.9	18.6	7.1	6.4	88.4	7.2	6.4	75.0	15.7	9.3
103	7	2	84.8	3.6	7.1	4.5	88.4	8.0	3.6	92.0	6.2	1.8
36	3	1	87.5	7.5	2.5	2.5	95.0	2.5	2.5	90.0	7.5	2.5
11			100.0				100.0			100.0		
63	5	7	80.0	12.0	4.0	4.0	92.0	15.3	2.7	84.0	6.7	9.3
5			100.0				100.0			100.0		
648	92	86	70.8	13.1	7.6	8.5	83.9	8.6	7.5	78.5	11.1	10.4
368	49	39	71.3	11.4	9.4	7.9	82.7	9.4	7.9	80.7	10.7	8.6
131	14	13	77.2	9.5	5.7	7.6	86.7	8.9	4.4	82.9	8.9	8.2
90	10	4	80.7	7.7	5.8	5.8	88.4	7.7	3.9	86.5	9.6	3.9
175	16	14	80.5	8.3	4.9	6.3	88.8	7.3	3.9	85.4	7.8	6.8
81	15	3	77.8	11.1	4.0	7.1	88.9	8.1	3.0	81.8	15.2	3.0
79	10	6	81.1	10.5	2.1	6.3	91.6	5.3	3.1	83.2	10.5	6.3
3,411	494	319	71.1	10.3	9.6	9.0	81.4	11.8	6.8	80.7	11.7	7.6
1,835	246	160	72.7	9.6	9.2	8.5	82.4	10.7	6.9	81.9	11.0	7.1
1,576	248	159	69.3	10.9	10.2	9.6	80.2	13.0	6.8	79.5	12.5	8.0
323	56	42	67.5	10.9	9.3	12.3	78.4	13.3	8.3	76.7	13.3	10.0
218	26	22	72.6	9.0	9.4	9.0	81.6	12.0	6.4	81.9	9.8	8.3
379	49	25	74.8	9.3	8.8	7.1	84.1	11.3	4.6	83.7	10.8	5.5
368	68	44	64.0	12.7	12.7	10.6	76.7	15.6	7.7	76.7	14.2	9.1
177	32	17	65.1	12.8	13.3	8.8	77.9	15.5	6.6	78.3	14.2	7.5
111	17	9	75.9	11.0	5.1	8.0	86.8	6.6	6.6	81.0	12.4	6.6
11,221	1,397	1,090	74.3	11.1	7.6	7.0	85.4	8.4	6.2	81.9	10.2	7.9
8,008	988	814	73.6	11.3	8.0	7.1	84.9	8.5	6.6	81.6	10.1	8.3
3,213	409	276	75.8	10.8	6.6	6.8	86.6	8.4	5.0	82.4	10.5	7.1
6,052	754	654	73.1	11.7	8.0	7.2	84.8	8.3	6.9	81.1	10.1	8.8
5,169	643	436	75.5	10.5	7.2	6.8	86.0	8.7	5.3	82.7	10.3	7.0

CENSUS STATISTICS ON MARITAL CONDITION: 1900 AND 1890.

Summary.—Census statistics on marital condition show that of the male population at least 15 years of age in California in 1900, 48.8 per cent were single, 44.9 per cent married, 4.7 per cent widowed, and 0.6 per cent divorced, 1.0 per cent being unknown. Of the female population of the same age, 31.1 per cent were single, 55.2 per cent married, 12.5 per cent widowed, and 0.9 per cent divorced, 0.3 per cent being unknown. The proportion single was greater and the proportion married less among males in California than in the United States, though the per cents single and married among females were not far from the same for this State as for the whole country. Between 1890 and 1900 the proportion of married men increased greatly in California on account of the growing equalization in the proportion of the sexes.

The per cent widowed among both males and females was substantially the same for California as for the United States in 1900 as well as 1890, but the per cent divorced for each sex was about twice as great for the Golden State as for the entire country at each census.

The proportion married among men is somewhat higher for cities of 25,000 population than for rural districts, including smaller cities, and is highest of all in California in Los Angeles and next in Oakland. The proportion married among women is considerably higher for rural districts than for the principal cities as a group, and is highest among the cities in Los Angeles and next in Sacramento.

Among the four principal cities Sacramento has the highest per cent of widowers and San Francisco has the highest per cent of widows. Sacramento also has the highest per cent divorced, both among men and women.

The maximum per cent married among males is at the age period 45 to 54 years—82.2 for the United States and 65.8 for California. The maximum per cent married among females, however, is at the next earlier age period, 35 to 44 years—79.5 for the entire country and 77.5 for the Golden State.

The maximum per cent widowed for each sex in both the United States and California is at the highest age period distinguished, 65 years and over.

The per cent divorced, however, is at its maximum for males at the age periods 45 to 54 and 55 to 64, and for females at still earlier age periods, 30 to 34 and 35 to 44.

The maximum per cent married among males is higher for cities of 100,000 population than for the rest of California, but the maximum per cent married among females is higher outside the two leading cities than within them. The maximum per cents married, among both men and women, are higher for Los Angeles than for San Francisco.

The maximum per cent of both widowers and widows is higher for

cities of 100,000 population than for the rest of the State, and is also higher for San Francisco than for Los Angeles.

In all cases the maximum per cent divorced appears later in life among men than among women.

For each sex in both the United States and California the proportion married is considerably higher for foreign-born than for native whites, but is nevertheless lower for descendants of foreigners than for persons of purely native stock. The same holds as to the proportions widowed. The per cent divorced for both sexes, however, is highest for native whites of native parentage, and is about the same for native whites of foreign parentage as for foreign-born whites themselves.

Generally speaking, what has just been said about the proportions married, widowed, and divorced in the United States and California holds true likewise for the two cities of 100,000 population and the rest of the Golden State.

As for the total population, so for each element of the white population, the maximum per cent married among males is at the age period 45 to 54, and among females at the age period 35 to 44, though in California the maximum per cent married among foreign-born white females is at an even earlier age period, 30 to 34 years. In all cases the maximum per cent widowed is at the age period 65 years and over, being about the same for each element. In every instance, also, the maximum per cent divorced is at a higher age period for males than for females.

United States and California.—Statistics of the Federal Census show the civil status or marital condition of the population—whether single, married, widowed, or divorced—at the dates when the last two censuses were taken in 1890 and 1900, respectively. Since practically all persons under 15 years of age are single this discussion is restricted throughout to the population at least 15 years of age, and, moreover, since marriage is essentially a sex relation the facts are considered not for both sexes together but always for males and females separately. The following table summarizes the data on marital condition for California in comparison with continental United States (the mainland south of the Canadian boundary) for 1900 and 1890:

TABLE 1.—*Population at Least 15 Years of Age classified by Sex and Marital Condition, with Per Cents, for United States and California: 1900 and 1890.*

	Total.	Single.	Married.	Widowed.	Divorced.	Unknown.
NUMBERS.						
UNITED STATES.						
Males— 1900	25,620,399	10,297,940	13,955,650	1,177,976	84,230	104,603
1890	20,777,872	8,655,711	11,205,205	815,437	49,100	52,419
Females—1900	24,249,191	7,566,530	13,810,057	2,717,715	114,647	40,242
1890	19,602,178	6,233,316	11,124,785	2,154,598	71,883	17,596
CALIFORNIA.						
Males— 1900	623,708	304,284	280,007	29,385	4,066	5,966
1890	533,145	288,343	216,029	19,222	2,586	6,966
Females—1900	471,514	146,754	260,277	59,048	4,268	1,167
1890	345,585	110,217	194,613	37,665	2,393	697

TABLE 1.—Population at Least 15 Years of Age classified by Sex and Marital Condition, with Per Cents, for United States and California: 1900 and 1890—Continued.

		Total.	Single.	Married.	Widowed.	Divorced.	Unknown.
PER CENTS.							
UNITED STATES.							
Males—	1900.....	100.0	40.2	54.5	4.6	0.3	0.4
	1890.....	100.0	41.7	53.9	3.9	0.2	0.3
Females—	1900.....	100.0	31.2	58.9	11.2	0.5	0.2
	1890.....	100.0	31.8	56.7	11.0	0.4	0.1
CALIFORNIA.							
Males—	1900.....	100.0	48.8	44.9	4.7	0.6	1.0
	1890.....	100.0	54.1	40.5	3.6	0.5	1.3
Females—	1900.....	100.0	31.1	55.2	12.5	0.9	0.3
	1890.....	100.0	31.9	56.3	10.9	0.7	0.2

Noticing only the per cents, one observes from the preceding table that at each census the proportion single was considerably greater and the proportion married was considerably less among males in California than in the United States, the differences being much smaller, however, in 1900 than in 1890. Among females, on the other hand, the per cents single and married were not far from the same for the Golden State as for the entire country at each census. Between 1890 and 1900 the per cent married increased slightly for both males and females in the United States and also increased greatly for males in California while decreasing somewhat for females. The notable increase in the proportion married among men in California is explained by the growing equalization of the sexes, the per cent male in the population of this State having fallen from 57.9 in 1890 to 55.3 in 1900. Thus the excess in the per cent married among women over that for men fell from 15.8 to 10.3 between 1890 and 1900, and similarly the excess in the per cent of males in the population over that for females dropped from 15.8 to 10.8 in the decade.

The per cent widowed was substantially the same in California as in the United States among males at each census and among females in 1890. The exceptional decrease in the per cent married among females in this State, noted above, is due to a considerable increase in the per cent widowed between 1890 and 1900. The per cent divorced, both among males and females, was about twice as great in California as in the United States at each census. In this State, as in the whole country, a larger proportion of women than of men are reported by the census as being widowed as well as divorced.

Cities and Rural Districts.—The Federal Census publishes statistics on marital condition not only for states and territories, but also for cities having at least 25,000 inhabitants. At the censuses of 1890 and 1900 there were four such cities in California—San Francisco, Los Angeles, Oakland, and Sacramento. The statistics at both censuses for each of these cities as well as for all four in contrast with the rural districts of the State appear in Table 2. Under "rural districts" are included all cities having less than 25,000 inhabitants, as well as country districts proper.

TABLE 2.—Population at Least 15 Years of Age classified by Sex and Marital Condition, with Per Cents, for Cities of 25,000 Inhabitants and Rural Districts of California: 1900 and 1890.

		Total.	Single.	Married.	Widowed.	Divorced.	Unknown.
NUMBERS.							
CITIES OF 25,000.							
Males—	1900	220,495	103,150	103,622	9,239	1,234	3,250
	1890	183,305	99,074	75,235	5,699	626	2,674
Females—	1900	192,919	64,646	98,192	27,607	1,800	674
	1890	136,175	47,142	70,713	17,109	989	222
<i>San Francisco.</i>							
Males—	1900	145,785	72,621	63,820	6,100	748	2,496
	1890	133,861	75,912	51,244	4,097	407	2,201
Females—	1900	118,553	40,984	58,982	17,261	1,011	365
	1890	93,818	33,689	47,464	11,871	627	167
<i>Los Angeles.</i>							
Males—	1900	37,777	14,519	21,066	1,539	269	384
	1890	19,430	8,226	10,319	641	99	145
Females—	1900	38,883	12,111	20,807	5,396	406	163
	1890	17,211	5,212	9,726	2,108	145	20
<i>Oakland.</i>							
Males—	1900	24,495	9,975	13,138	1,049	137	196
	1890	17,821	7,911	9,173	561	66	110
Females—	1900	25,314	8,435	13,019	3,566	250	44
	1890	17,081	5,681	9,180	2,071	121	28
<i>Sacramento.</i>							
Males—	1900	12,438	6,035	5,598	551	80	174
	1890	12,193	7,025	4,499	400	54	215
Females—	1900	10,169	3,116	5,434	1,384	133	102
	1890	8,065	2,560	4,343	1,059	96	7
RURAL DISTRICTS.							
Males—	1900	403,213	201,134	176,385	20,146	2,832	2,716
	1890	349,840	189,269	140,794	13,523	1,960	4,294
Females—	1900	278,595	82,108	162,085	31,441	2,468	493
	1890	209,410	63,075	123,900	20,556	1,404	475
PER CENTS.							
CITIES OF 25,000.							
Males—	1900	100.0	46.8	47.0	4.2	0.5	1.5
	1890	100.0	54.1	41.0	3.1	0.3	1.5
Females—	1900	100.0	33.5	50.9	14.3	0.9	0.4
	1890	100.0	34.6	51.9	12.6	0.7	0.2
<i>San Francisco.</i>							
Males—	1900	100.0	49.8	43.8	4.2	0.5	1.7
	1890	100.0	56.7	38.3	3.1	0.3	1.6
Females—	1900	100.0	34.6	49.7	14.6	0.8	0.3
	1890	100.0	35.9	50.6	12.6	0.7	0.2
<i>Los Angeles.</i>							
Males—	1900	100.0	38.4	55.8	4.1	0.7	1.0
	1890	100.0	42.3	53.1	3.3	0.5	0.8
Females—	1900	100.0	31.2	53.5	13.9	1.0	0.4
	1890	100.0	30.3	56.5	12.3	0.8	0.1
<i>Oakland.</i>							
Males—	1900	100.0	40.7	53.6	4.3	0.6	0.8
	1890	100.0	44.4	51.5	3.1	0.4	0.6
Females—	1900	100.0	33.3	51.4	14.1	1.0	0.2
	1890	100.0	33.3	53.7	12.1	0.7	0.2
<i>Sacramento.</i>							
Males—	1900	100.0	48.5	45.0	4.4	0.7	1.4
	1890	100.0	57.6	36.9	3.3	0.4	1.8
Females—	1900	100.0	30.7	53.4	13.6	1.3	1.0
	1890	100.0	31.7	53.9	13.1	1.2	0.1
RURAL DISTRICTS.							
Males—	1900	100.0	49.9	43.7	5.0	0.7	0.7
	1890	100.0	54.1	40.2	3.9	0.6	1.2
Females—	1900	100.0	29.4	58.2	11.3	0.9	0.2
	1890	100.0	30.1	59.2	9.8	0.7	0.2

Examination of the per cents in Table 2, relating to cities of 25,000 inhabitants and the rural districts of California, shows that the increase in the per cent married among males, heretofore noted, appeared in each of the four principal cities as well as in the rural districts of the State. The increase was considerably greater for the four cities together than for the rural districts, while among the individual cities the increase was greatest for Sacramento and next for San Francisco. The decrease in the per cent married among females, which likewise appeared in each city as well as in the rural districts, was the same for the four cities together as for the rural districts, and among the individual cities was greatest for Los Angeles and next for Oakland. The proportion married among men is somewhat higher in cities than in rural districts, being highest of all in Los Angeles and next in Oakland. On the other hand, the proportion married among women is considerably higher in rural districts than in cities of 25,000 population, being highest among the cities in Los Angeles and next in Sacramento.

Between 1890 and 1900 the per cents widowed and divorced, both among males and females, increased in each of the four principal cities as well as in the rural districts. The per cent of widowers is somewhat less for cities of 25,000 inhabitants than for rural districts, while the per cent of widows is considerably greater in these cities than in the rural districts. Among the cities the highest per cent of widowers is in Sacramento, and of widows in San Francisco. There is little variance between urban and rural districts in the per cent divorced among men, and none at all in the per cent divorced among women. The per cent divorced, among men as well as women, is highest in Sacramento.

Age.—Age is an important factor in connection with marriage. To facilitate comparisons for the eight age periods distinguished by the Federal Census, the statistical data herewith presented are limited to per cent distributions, the first table showing the facts for the United States in contrast with California in 1900.

TABLE 3.—*Per Cent Distribution, by Marital Condition, of Population at Least 15 Years of Age, classified by Sex and Age Periods, for United States and California: 1900.*

	PER CENT DISTRIBUTION BY MARITAL CONDITION.									
	15 Years and Over.	15 to 19 Years.	20 to 24 Years.	25 to 29 Years.	30 to 34 Years.	35 to 44 Years.	45 to 54 Years.	55 to 64 Years.	65 Years and Over.	Age Un- known
UNITED STATES.										
<i>Males.</i>										
Single.....	40.2	98.8	77.6	45.8	27.6	16.9	10.3	7.6	5.7	28.6
Married.....	54.5	1.0	21.6	52.5	69.8	78.8	82.2	79.7	67.1	28.5
Widowed.....	4.6	*	0.4	1.2	2.0	3.6	6.8	11.9	26.4	3.5
Divorced.....	0.3	*	0.1	0.2	0.4	0.5	0.6	0.6	0.5	0.3
Unknown.....	0.4	0.2	0.3	0.3	0.2	0.2	0.1	0.2	0.3	39.1
<i>Females.</i>										
Single.....	31.2	88.7	51.6	27.5	16.6	11.1	7.8	6.6	6.0	24.6
Married.....	56.9	10.9	46.5	68.9	78.0	79.5	73.9	60.5	34.2	40.1
Widowed.....	11.2	0.2	1.4	2.9	4.6	8.6	17.6	32.3	59.3	15.7
Divorced.....	0.5	0.1	0.4	0.6	0.7	0.7	0.6	0.5	0.3	0.7
Unknown.....	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	18.9

in of 1 per cent.

TABLE 3.—*Per Cent Distribution, by Marital Condition, of Population at Least 15 Years of Age, classified by Sex and Age Periods, for United States and California: 1900—Continued.*

	PER CENT DISTRIBUTION BY MARITAL CONDITION.									
	15 Years and Over.	15 to 19 Years.	20 to 24 Years.	25 to 29 Years.	30 to 34 Years.	35 to 44 Years.	45 to 54 Years.	55 to 64 Years.	65 Years and Over.	Age Un- known
CALIFORNIA.										
<i>Males.</i>										
Single	48.8	99.4	88.4	64.4	45.7	34.4	26.8	23.7	20.4	31.1
Married	44.9	0.4	10.8	34.0	51.8	61.5	65.8	63.3	54.7	19.5
Widowed	4.7	*	0.1	0.7	1.5	2.9	6.0	11.5	23.3	1.9
Divorced	0.6	*	0.1	0.4	0.6	0.8	1.1	1.2	1.1	0.2
Unknown	1.0	0.2	0.6	0.5	0.4	0.4	0.3	0.3	0.5	47.3
<i>Females.</i>										
Single	31.1	92.2	60.0	32.9	18.7	11.2	6.3	4.8	4.2	22.0
Married	55.2	7.5	38.3	63.3	75.1	77.5	71.4	58.1	35.7	40.3
Widowed	12.5	0.1	0.9	2.6	4.8	9.8	21.0	36.4	59.4	13.2
Divorced	0.9	0.1	0.6	1.1	1.3	1.4	1.2	0.7	0.5	0.7
Unknown	0.3	0.1	0.2	0.1	0.1	0.1	0.1	*	0.2	23.8

* Less than one tenth of 1 per cent.

The preceding table shows that the per cent single invariably decreases at successive age periods, but that the per cent married, after increasing through the prime of life, then decreases with the rise in the per cent widowed among old-aged persons. The age period, 45 to 54 years, shows the maximum per cent married among males—82.2 in the United States and 65.8 in California. The maximum per cent married among females, however, is at the next earlier age period, 35 to 44 years, being 79.5 for the entire country and 77.5 for the Golden State. Among males as well as females, and in both the United States and California, the per cent widowed rises at successive age periods to the maximum at the highest period distinguished, 65 years and over. On the other hand, the per cent divorced, like the per cent married, first rises and then falls. The per cent divorced among males is highest at the age periods 45 to 54 and 55 to 64, being 0.6 in each case for the United States, and 1.1 and 1.2, respectively, for California. The maximum per cent divorced among females, however, appears at earlier age periods, 30 to 34 and 35 to 44, the per cent being 0.7 in both instances for the entire country, and 1.3 and 1.4, respectively, for the Golden State.

Corresponding figures for the cities of 100,000 inhabitants, San Francisco and Los Angeles, in contrast with the rest of California, appear in Table 4, on page 78. The returns for cities of less than 100,000 population in 1900 were not tabulated by the Federal Census, so that Oakland and Sacramento can not be shown separately, but must be included in the rest of the State outside the two leading cities, San Francisco and Los Angeles.

TABLE 4.—Per Cent Distribution, by Marital Condition, of Population at Least 15 Years of Age, classified by Sex and Age Periods, for Cities of 100,000 Inhabitants and Rest of California: 1900.

	PER CENT DISTRIBUTION BY MARITAL CONDITION.									
	15 Years. and Over.	15 to 19 Years.	20 to 24 Years.	25 to 29 Years.	30 to 34 Years.	35 to 44 Years.	45 to 54 Years.	55 to 64 Years.	65 Years and Over.	Age Un- known.
CITIES OF 100,000.										
<i>Males.</i>										
Single	47.5	99.4	87.6	63.9	44.1	32.4	23.0	18.3	15.6	36.0
Married	46.2	0.5	11.1	34.2	53.3	63.6	69.6	68.0	58.4	14.4
Widowed	4.2	*	0.1	0.7	1.4	2.8	6.0	12.5	24.9	1.0
Divorced	0.5	---	0.1	0.3	0.5	0.8	1.0	1.0	0.8	0.1
Unknown	1.6	0.1	1.1	0.9	0.7	0.4	0.4	0.2	0.3	48.5
<i>Females.</i>										
Single	33.7	93.6	64.7	37.6	22.1	13.8	7.9	6.3	5.9	23.9
Married	50.7	6.1	33.7	58.1	70.3	71.8	63.9	49.3	27.8	30.2
Widowed	14.4	0.1	1.0	3.1	6.2	12.9	27.1	43.8	65.6	11.9
Divorced	0.9	0.1	0.5	1.1	1.3	1.4	1.0	0.6	0.4	0.7
Unknown	0.3	0.1	0.1	0.1	0.1	0.1	0.1	*	0.3	33.3
SAN FRANCISCO.										
<i>Males.</i>										
Single	49.8	99.4	88.4	65.9	46.6	35.2	25.3	20.4	17.6	37.6
Married	43.8	0.5	10.2	32.2	50.8	60.8	67.2	65.3	55.5	13.4
Widowed	4.2	*	0.1	0.6	1.4	2.8	6.3	13.2	25.9	0.7
Divorced	0.5	---	0.1	0.3	0.4	0.8	0.9	0.9	0.7	0.1
Unknown	1.7	0.1	1.2	1.0	0.8	0.4	0.3	0.2	0.3	48.2
<i>Females.</i>										
Single	34.6	93.8	65.3	38.5	22.4	14.2	7.8	6.5	6.5	26.1
Married	49.7	5.9	33.1	57.5	70.1	70.9	62.7	47.1	26.1	28.5
Widowed	14.6	0.1	1.0	2.9	6.2	13.4	28.5	45.8	66.9	12.9
Divorced	0.8	0.1	0.5	1.0	1.2	1.4	1.0	0.6	0.3	0.8
Unknown	0.3	0.1	0.1	0.1	0.1	0.1	*	*	0.2	31.7
LOS ANGELES.										
<i>Males.</i>										
Single	38.4	99.2	83.7	54.5	33.5	21.8	15.0	11.9	9.0	21.5
Married	55.8	0.6	15.5	43.8	64.1	74.0	78.0	76.7	68.0	23.0
Widowed	4.1	*	0.2	0.7	1.6	2.7	5.2	10.0	21.5	3.2
Divorced	0.7	---	0.1	0.4	0.5	0.9	1.2	1.2	1.2	0.8
Unknown	1.0	0.2	0.5	0.6	0.3	0.6	0.6	0.2	0.3	51.5
<i>Females.</i>										
Single	31.2	92.9	62.3	34.5	20.9	12.7	8.2	5.7	4.4	16.8
Married	53.5	6.8	35.6	60.2	70.9	74.2	67.2	55.4	32.3	35.9
Widowed	13.9	0.1	1.3	3.6	6.5	11.5	23.3	38.2	61.9	8.4
Divorced	1.0	0.1	0.6	1.5	1.5	1.5	1.3	0.6	0.6	0.4
Unknown	0.4	0.1	0.2	0.2	0.2	0.1	*	0.1	0.8	38.5
REST OF CALIFORNIA.										
<i>Males.</i>										
Single	49.3	99.3	88.8	64.7	46.5	35.4	28.3	25.4	21.7	25.7
Married	44.3	0.4	10.6	33.9	51.0	60.5	64.4	61.8	53.7	25.3
Widowed	5.0	*	0.1	0.7	1.6	3.0	6.1	11.2	22.9	2.9
Divorced	0.7	*	0.1	0.4	0.6	0.8	0.9	1.2	1.2	0.3
Unknown	0.7	0.3	0.4	0.3	0.3	0.3	0.3	0.4	0.5	45.8
<i>Females.</i>										
Single	29.8	91.6	57.5	30.2	16.9	10.0	5.5	4.1	3.5	20.8
Married	57.5	8.0	40.8	66.3	77.8	80.4	75.1	62.0	38.8	47.1
Widowed	11.6	0.1	0.9	2.4	4.0	8.2	18.0	33.0	57.0	14.0
Divorced	0.9	0.1	0.6	1.0	1.2	1.4	1.3	0.8	0.5	0.6
Unknown	0.2	0.2	0.2	0.1	0.1	*	0.1	0.1	0.2	17.5

* Less than one tenth of 1 per cent.

Table 4 shows that, as before, the maximum per cent married among males is at the age period 45 to 54, and among females at the preceding period, 35 to 44 years. The maximum per cent married among males is higher for cities of 100,000 inhabitants than for the rest of California, and is also higher for Los Angeles than for San Francisco. Among females, however, the maximum per cent married is higher outside the two leading cities than within them, but as in the case of males it is higher for the City of Angels than for the City by the Golden Gate. As for the United States and California, so for the two cities of 100,000 inhabitants and the rest of the State the per cent of widowers and widows reaches its maximum at the age period 65 years and over. The maximum per cent of widowers is higher for cities of 100,000 population than for the rest of the State, and is likewise higher for San Francisco than for Los Angeles. Similarly, the maximum per cent of widows is greater within these two cities than outside them and is also greater in San Francisco than in Los Angeles. As heretofore shown for the entire country and the Golden State, so in the two cities of 100,000 population and the rest of California the maximum per cent divorced appears later in life among men than among women.

Race, Nativity, and Parentage.—Race as well as age is important with respect to marriage. Since the population of the United States, especially California, is predominantly of the white or Caucasian race, study of the effect of race upon marriage must be extended to an analysis of the statistical data according to the nativity of the whites and the parentage of the native whites. This is done in the following table for the United States and California in 1900, both numbers and per cents being shown:

TABLE 5.—*Population at Least 15 Years of Age, classified by Sex, Race, Nativity, Nativity of Parents, and Marital Condition, with Per Cents, for United States and California: 1900.*

	Total.	Single.	Married.	Widowed.	Divorced.	Un-known.
NUMBERS.						
UNITED STATES.						
<i>Males.</i>						
White	22,808,628	9,173,430	12,455,858	1,020,387	72,761	86,192
Native, native parents.	13,088,058	5,195,263	7,193,922	587,894	47,998	62,986
Native, foreign parents	4,463,211	2,432,374	1,906,380	106,055	11,422	6,980
Foreign-born	5,257,359	1,545,793	3,355,556	326,438	13,346	16,226
Non-Caucasian	2,811,771	1,124,510	1,499,792	157,589	11,469	18,411
<i>Females.</i>						
White	21,483,052	6,747,306	12,319,767	2,291,872	91,737	32,370
Native, native parents	12,561,813	3,893,417	7,251,375	1,332,334	62,585	22,102
Native, foreign parents	4,475,907	1,985,289	2,212,946	256,953	16,634	4,085
Foreign-born	4,445,332	868,600	2,855,446	702,585	12,518	6,183
Non-Caucasian	2,766,139	819,224	1,490,290	425,843	22,910	7,872
CALIFORNIA.						
<i>Males.</i>						
White	563,694	271,156	255,965	27,955	4,000	4,618
Native, native parents.	237,666	108,884	111,099	12,287	1,977	3,419
Native, foreign parents	138,437	86,762	46,961	3,549	825	340
Foreign-born	187,591	75,510	97,905	12,119	1,198	859
Non-Caucasian	60,014	33,128	24,042	1,430	66	1,348
<i>Females.</i>						
White	459,612	143,897	253,251	57,208	4,162	1,094
Native, native parents	203,174	62,961	112,450	24,863	2,142	758
Native, foreign parents	135,918	61,291	64,416	8,864	1,174	173
Foreign-born	120,520	19,645	76,385	23,481	846	163
Non-Caucasian	11,902	2,857	7,026	1,840	106	73

the per cent divorced, among both males and females, is highest for native whites of native parentage, and is about the same for native whites of foreign parentage as for foreign-born whites both within and outside the two cities of 100,000 population, the principal exception being that among males in Los Angeles the per cent divorced is slightly higher for foreign-born whites than for native whites of either native or foreign parentage.

Race and Age.—Table 7 has been prepared to facilitate analysis of the marital condition of males and females classified by race, nativity, and parentage at successive age periods. For convenience, as before, only the per cent distribution is shown, and the data presented are also limited to the State of California in 1900. Corresponding figures for continental United States may be found in the Abstract of the Twelfth Census, 1900, Tables 24 and 25, pages 20-23.

TABLE 7.—*Per Cent Distribution, by Marital Condition, of Population at Least 15 Years of Age, classified by Sex, Race, Nativity, Nativity of Parents, and Age Periods, for California: 1900.*

	PER CENT DISTRIBUTION BY MARITAL CONDITION.									
	15 Years and Over.	15 to 19 Years.	20 to 24 Years.	25 to 29 Years.	30 to 34 Years.	35 to 44 Years.	45 to 54 Years.	55 to 64 Years.	65 Years and Over.	Age Un- known.
MALES.										
<i>White.</i>										
Single.....	48.1	99.5	88.7	64.1	44.9	32.2	23.9	21.7	19.8	33.8
Married.....	45.4	0.3	10.6	34.4	52.6	63.5	68.2	64.6	35.1	16.6
Widowed.....	5.0	*	0.1	0.7	1.5	3.1	6.5	12.2	23.6	1.6
Divorced.....	0.7	*	0.1	0.4	0.6	0.9	1.2	1.3	1.1	0.2
Unknown.....	0.8	0.2	0.5	0.4	0.4	0.3	0.2	0.2	0.4	47.8
<i>Native white, native par'nts</i>										
Single.....	45.8	99.4	86.5	58.8	40.1	27.8	19.3	17.6	16.8	24.3
Married.....	46.8	0.4	12.3	39.2	56.8	67.1	72.2	68.8	58.6	12.4
Widowed.....	5.2	*	0.2	0.8	1.8	3.6	6.8	11.8	22.9	0.9
Divorced.....	0.8	*	0.1	0.5	0.7	1.2	1.5	1.5	1.3	0.3
Unknown.....	1.4	0.2	0.9	0.7	0.6	0.3	0.2	0.3	0.4	62.1
<i>Native white, for'gn par'nts</i>										
Single.....	62.7	99.6	90.9	67.5	47.6	34.4	26.8	24.6	22.0	42.2
Married.....	33.9	0.2	8.6	31.2	49.9	61.1	64.9	59.8	52.4	29.1
Widowed.....	2.6	*	0.1	0.7	1.5	3.2	6.8	13.8	23.9	0.9
Divorced.....	0.6	---	0.1	0.4	0.8	1.1	1.3	1.6	1.4	0.4
Unknown.....	0.2	0.2	0.3	0.2	0.2	0.2	0.2	0.2	0.3	27.4
<i>Foreign-born white.</i>										
Single.....	40.2	99.2	89.4	68.3	48.1	35.3	26.9	24.6	22.8	53.5
Married.....	52.2	0.6	10.2	30.8	50.0	61.3	65.7	61.9	51.5	24.2
Widowed.....	6.5	*	0.1	0.5	1.3	2.6	6.2	12.2	24.3	3.2
Divorced.....	0.6	---	*	0.1	0.3	0.6	0.9	1.0	0.9	0.1
Unknown.....	0.5	0.2	0.3	0.3	0.3	0.2	0.3	0.3	0.5	19.0
<i>Non-Caucasian.</i>										
Single.....	55.2	97.5	84.8	68.5	54.8	49.9	45.1	41.6	34.2	21.5
Married.....	40.1	1.9	13.6	29.7	42.8	47.2	51.4	51.9	47.2	29.9
Widowed.....	2.4	*	0.2	0.8	1.0	1.7	2.4	5.3	17.5	3.1
Divorced.....	0.1	---	0.1	0.1	0.2	0.1	0.1	0.1	0.2	0.1
Unknown.....	2.2	0.6	1.3	0.9	1.2	1.1	1.0	1.1	0.9	45.4

* Less than one tenth of 1 per cent.

TABLE 7.—*Per Cent Distribution, by Marital Condition, of Population at Least 15 Years of Age, classified by Sex, Race, Nativity, Nativity of Parents, and Age Periods, for California: 1900—Continued.*

	PER CENT DISTRIBUTION BY MARITAL CONDITION.									
	15 Years and Over.	15 to 19 Years.	20 to 24 Years.	25 to 29 Years.	30 to 34 Years.	35 to 44 Years.	45 to 54 Years.	55 to 64 Years.	65 Years and Over.	Age Un- known
FEMALES.										
<i>White.</i>										
Single	31.3	92.6	60.5	33.2	18.8	11.3	6.3	4.8	4.2	22.2
Married	55.1	7.1	37.9	63.1	75.1	77.5	71.5	58.1	35.7	36.4
Widowed	12.5	0.1	0.9	2.5	4.7	9.7	20.9	36.3	59.4	12.4
Divorced	0.9	0.1	0.6	1.1	1.3	1.4	1.2	0.7	0.5	0.4
Unknown	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	28.6
<i>Native white, native par'nts</i>										
Single	31.0	92.1	57.0	30.1	17.4	10.8	5.8	4.1	3.3	20.9
Married	55.3	7.6	41.1	65.7	76.0	78.0	73.2	61.2	37.4	34.0
Widowed	12.2	0.1	1.0	2.8	4.9	9.4	19.4	33.8	58.5	7.2
Divorced	1.1	0.1	0.7	1.3	1.6	1.7	1.5	0.8	0.6	0.6
Unknown	0.4	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.2	37.3
<i>Native white, for'gn par'nts</i>										
Single	45.1	94.2	66.1	39.4	23.7	14.2	7.4	5.2	4.5	45.7
Married	47.4	5.5	32.6	57.0	70.0	73.9	70.3	56.0	34.0	32.8
Widowed	6.5	*	0.7	2.4	5.0	10.3	21.1	38.0	60.9	7.5
Divorced	0.9	0.1	0.5	1.1	1.2	1.6	1.2	0.8	0.2	—
Unknown	0.1	0.2	0.1	0.1	0.1	*	—	*	0.4	14.0
<i>Foreign-born white.</i>										
Single	16.3	87.0	54.2	27.0	14.7	9.5	6.4	5.3	5.1	17.9
Married	63.4	12.6	44.3	70.1	80.3	80.1	70.2	55.6	34.0	43.2
Widowed	19.5	0.2	0.9	2.1	4.2	9.6	22.4	38.4	60.3	26.6
Divorced	0.7	*	0.5	0.7	0.7	0.8	1.0	0.6	0.4	0.2
Unknown	0.1	0.2	0.1	0.1	0.1	*	*	0.1	0.2	12.1
<i>Non-Caucasian.</i>										
Single	24.0	77.8	42.3	24.0	13.6	7.2	5.6	5.7	4.2	21.5
Married	59.0	21.3	53.0	68.0	77.0	77.6	67.7	53.8	35.2	55.8
Widowed	15.5	0.7	3.3	6.7	8.1	13.8	25.3	39.3	58.9	15.9
Divorced	0.9	0.1	0.8	0.9	1.1	1.1	1.0	0.8	1.0	1.6
Unknown	0.6	0.1	0.6	0.4	0.2	0.3	0.4	0.4	0.7	5.2

* Less than one tenth of 1 per cent.

Table 7 shows that in California the maximum per cent married among males is at the age period 45 to 54 years for native whites of native and foreign parentage as well as for foreign-born whites. Among females, however, the maximum per cent married is at the preceding age period, 35 to 44, for native whites of native and foreign parentage, and even earlier, 30 to 34 years, for foreign-born whites. In all cases the maximum per cent of widowers and widows is at the highest age period distinguished, 65 years and over, the maximum per cents being not far from the same for each element of the population. In every instance, also, the maximum per cent divorced is found at a higher age period among men than among women.

STATISTICS OF DEATHS: 1905-1906.

Summary.—In the first year covered by the new law requiring the proper registration of deaths prior to the issuance of burial permits, returns from all fifty-seven counties of California give a total of 27,026 deaths, exclusive of stillbirths, 12,385 being for the last half of 1905 and 14,641 for the first half of 1906.

For an estimated State population of 1,784,521 in 1905, the 27,026 deaths in 1905-1906 give a rate of 15.1 per 1,000 population.

The death-rate is 11.5 for Northern California, 15.1 for Central California, and 17.6 for Southern California.

The death-rates are only 12.0 and 11.1, respectively, for the coast and interior counties of Northern California, but the returns were not particularly complete for some counties in this part of the State.

The death-rate is highest, 17.9, for Los Angeles, and next, 17.1, for the other six counties of Southern California, being swollen in each case by the many deaths of recent residents, especially from tuberculosis.

The death-rate is also above the State average for the coast counties of Central California, 16.4, and for San Francisco, 15.6, where fatalities in the April earthquake and fire increased the mortality appreciably.

The rate is below the State average, 15.1, not only for the coast and interior counties of Northern California, but also for the bay counties other than San Francisco (14.5), and for the interior counties from Yolo, Sacramento, and El Dorado to and including Kern (14.4).

The rate is 15.2 for the metropolitan area, against 13.6 for the rural counties north of Tehachapi.

The principal cause of death in California is tuberculosis, which caused 15.5 per cent of the total deaths. The death-rate for tuberculosis of the lungs and other organs is 234.4 per 100,000 population.

Next to tuberculosis come diseases of the circulatory, respiratory, and nervous systems, which caused respectively 12.6, 10.8, and 9.8 per cent of the total deaths. Or, from another point of view, the death-rate per 100,000 population, is 191.3 for diseases of the circulatory system, heart disease, etc., 163.6 for pneumonia and other diseases of the respiratory system, and 147.8 for meningitis and other diseases of the nervous system.

The proportions are next highest for diseases of the digestive system (diarrhea and enteritis, etc.), violence other than suicide or public calamity, cancer, Bright's disease, and early infancy.

The most fatal epidemic disease was typhoid fever, causing 425 deaths, or 1.6 per cent of the State total. Next were diphtheria and croup, influenza, whooping-cough, measles, malarial fever, scarlet fever, and smallpox.

There are 709 deaths known to have resulted directly or indirectly from earthquake and fire, distributed as follows: San Francisco, 463; Santa Clara, 141; Sonoma, 72; Alameda, 12, and other counties, 21.

The deaths in Santa Clara county were mainly at Agnews State Hospital, and in Sonoma county mainly in Santa Rosa city. Most of the deaths in Alameda and other counties occurred among refugees from San Francisco suffering from fright or exposure.

Analysis of causes of death in different localities reveals marked contrasts between the several geographic divisions in the relative prevalence of various diseases.

In the coast counties of both Northern and Central California, as well as in the six counties of Southern California other than Los Angeles, relatively high proportions of all deaths are due to diseases of the nervous system, the explanation being the presence of State hospitals in these three geographic divisions.

The interior counties of both Northern and Central California have high proportions of total deaths due to malarial fever, typhoid fever, and other epidemic diseases. The present low death-rates for these geographic divisions could be further reduced by stricter enforcement of the health laws.

In San Francisco, and to a less extent in the other bay counties, the proportion is very high for diseases of the circulatory system, heart disease and kindred complaints.

In Los Angeles, as well as the other counties of Southern California, the proportions are very high for tuberculosis, on account of the many deaths occurring among newcomers from the East.

Tuberculosis caused 4,183 deaths, or 15.5 per cent of the State total. The per cent ranges from 22.2 for Los Angeles, and 20.8 for the other counties south of Tehachapi, to 11.9 for the bay counties other than San Francisco, and only 10.6 for the interior counties of Northern California.

However, deaths from tuberculosis in Southern California occur largely among newly arrived consumptives. Thus, 27.8 per cent of the tuberculosis victims in Southern California had lived in the State less than a year, and altogether 58.2 per cent had lived here less than ten years, the corresponding per cents for the entire State being 13.3 and 33.2, and for Northern and Central California together being 4.6 and 18.2 respectively. In fact, of all who died of tuberculosis in Southern California, 3.5 per cent had been in the State less than a month, altogether 10.8 per cent less than three months, and altogether 18.4 per cent less than six months.

In Northern and Central California, on the other hand, considerable numbers of native Californians and old-time residents fall victims to the "great white plague." The per cent of native Californians among tuberculosis victims is 37.3 for Northern California, and 36.9 for Central California, as compared with only 14.1 for Southern California, and 28.4 for the State as a whole. Similarly, the per cent who had lived here at least ten years is 33.7 for both Northern and Central California, against 19.5 for Southern California, and 28.4 for the entire State.

Of the 27,026 deaths, 16,681, or 61.7 per cent, were male and 10,345, or 38.3 per cent, were female. The per cent male is highest for the interior counties of Northern California, and is lowest for Los Angeles.

The white decedents numbered 25,463, or 94.2 per cent of all, while the Chinese were 731, the negroes 400, the Japanese 319, and the Indians 113.

The per cent white is highest for the six counties of Southern California other than Los Angeles and is lowest for the interior counties of Central California.

The per cents Chinese and Japanese are highest for the interior counties of Central California. The per cent negro is highest for Los Angeles, and the per cent Indian is highest for the coast counties of Northern California.

Of the white decedents, 8,993, or 35.3 per cent, were born in other states than California; 8,155, or 32.0 per cent, were foreign born; 7,193, or 28.3 per cent, were born in California; and 1,122, or 4.4 per cent, were of unknown nativity.

The per cent born in California is highest for San Francisco and the other bay counties, and is lowest for Los Angeles. Conversely, the per cent born in other states is highest for Los Angeles and the other counties south of Tehachapi, but is lowest for San Francisco. The per cent foreign born, however, is highest for the metropolis and lowest for Southern California outside Los Angeles.

The deaths by age periods were as follows: 15 to 64 years, or the "productive ages," 14,213 or 52.6 per cent; 65 years and over, or old age, 7,324 or 27.1 per cent; under 1 year, or early infancy, 2,953 or 10.9 per cent; 1 to 4 years, or childhood, 1,212 or 4.5 per cent; 5 to 14 years, or youth, 891 or 3.3 per cent; and age unknown, 433 or 1.6 per cent.

The per cent of deaths in early infancy is highest for the bay counties other than San Francisco and next for the metropolis itself.

The per cent of deaths in childhood is highest for the six counties of Southern California other than Los Angeles.

The per cent of deaths in youth is highest for Los Angeles and for both the coast and interior counties of Northern California.

The per cent of deaths at the productive ages is highest for Los Angeles and next for San Francisco.

The per cent of deaths at old age is highest for the interior and coast counties of Northern California.

Geographic Divisions.—For convenience in tabulation the fifty-seven counties of California have been grouped in three main and eight minor geographic divisions. The three main divisions are Northern, Central, and Southern California. The line between Northern and Central California has been drawn at the southern boundary of Placer, Sutter, Colusa, Napa, and Sonoma counties, or the northern boundary of El Dorado, Sacramento, Yolo, and Marin counties. This dividing line extends irregularly from Lake Tahoe to the Pacific Ocean somewhat north of San Francisco Bay. The line between Central and Southern California has been drawn at the southern boundary of Inyo, Kern, and San Luis Obispo counties, or the northern boundary of San Bernardino, Los Angeles, Ventura, and Santa Barbara counties. This line is familiarly located by Tehachapi pass.

In both Northern and Central California, divisions have been made between the coast and the interior counties. In each case the coast counties include some counties not actually contiguous to the Pacific Ocean but yet on the westward side of the Coast Ranges. Moreover, in Central California, San Francisco, and the other bay counties (Alameda, Contra Costa, Marin, and San Mateo) have been made minor geographic divisions. Similarly, in Southern California, Los Angeles has been made a minor geographic division in contrast with the other six counties south of Tehachapi.

The three main and eight minor geographic divisions are as follows, the counties in each group being arranged alphabetically for the sake of ready reference:

Main and Minor Geographic Divisions of California, with Counties included in each.

NORTHERN CALIFORNIA.

Coast Counties.

Del Norte
Humboldt

Lake
Mendocino

Napa
Sonoma

Trinity

Interior Counties.

Butte
Colusa
Glenn
Lassen

Modoc
Nevada
Placer
Plumas

Shasta
Sierra
Siskiyou

Sutter
Tehama
Yuba

CENTRAL CALIFORNIA.

San Francisco

(City and County)

Other Bay Counties.

Alameda

Contra Costa

Marin

San Mateo

Coast Counties.

Monterey
San Benito

San Luis Obispo

Santa Clara

Santa Cruz

Interior Counties.

Alpine
Amador
Calaveras
El Dorado
Fresno

Inyo
Kern
Kings
Madera
Mariposa

Merced
Mono
Sacramento
San Joaquin
Solano

Stanislaus
Tulare
Tuolumne
Yolo

SOUTHERN CALIFORNIA.

Los Angeles.

Other Counties.

Orange
Riverside

San Bernardino
San Diego

Santa Barbara

Ventura

Death-rates.—Under the law of 1905 requiring the proper registration of deaths prior to the issuance of burial permits, returns of varying completeness were received in the fiscal year 1905-1906 from all the fifty-seven counties in the State. In order to calculate death-rates the population of California in 1905 has been estimated conservatively according to the Census Bureau method by adding to the population in 1900 five tenths of the increase between 1890 and 1900, except that for the few counties showing decreases between the last two Federal censuses the population in 1900 has been taken for 1905, and for the three principal cities arbitrary estimates have been made because of their exceptionally rapid growth. The estimate for San Francisco in 1905 is 450,000, for Los Angeles 180,000, and for Oakland 90,000.

The following table shows the population as thus estimated in 1905, the deaths, exclusive of stillbirths, reported for 1905-1906, and the death-rate per 1,000 population, for each geographic division indicated above as well as for certain combinations of these divisions:

TABLE 1.—*Estimated Population (1905), Deaths, and Death-rate per 1,000 Population, for Geographic Divisions: 1905-1906.*

Geographic Division.	Estimated Population: 1905.	Deaths: 1905-1906.	Death-rate per 1,000 Population.
THE STATE	1,784,521	27,026	15.1
Northern California	269,510	3,093	11.5
Coast counties	121,785	1,457	12.0
Interior counties	147,725	1,636	11.1
Central California	1,105,090	16,720	15.1
San Francisco	450,000	7,010	15.6
Other bay counties	216,127	3,133	14.5
Coast counties	132,371	2,176	16.4
Interior counties	306,592	4,401	14.4
Southern California	409,921	7,213	17.6
Los Angeles	259,000	4,638	17.9
Other counties	150,921	2,575	17.1
Northern and Central California	1,374,600	19,813	14.4
Coast counties	920,283	13,776	15.0
Interior counties	454,317	6,037	13.3
Metropolitan area	666,127	10,143	15.2
Rural counties	708,473	9,670	13.6

It appears from Table 1 that for an estimated State population of 1,784,521 in 1905, the 27,026 deaths in 1905-1906 give a rate of 15.1 per 1,000 population.

Of the main geographic divisions, Northern California shows the lowest death-rate, 11.5, and Southern California the highest, 17.6, the rate for Central California being the same as for the State, 15.1.

Of the minor divisions, both the coast and interior counties of Northern California have death-rates, 12.0 and 11.1 respectively, which are considerably below the State average. In explanation of these low death-rates, however, it should be noted that the returns were not particularly complete for several counties in Northern California.

The death-rate is highest, 17.9, for Los Angeles and next, 17.1, for the other six counties of Southern California. The relatively high death-rates in this part of the State are due largely to the many deaths of recent residents, especially from tuberculosis.

The death-rate is also above the State average for the coast counties of Central California, 16.4, as well as for San Francisco, 15.6. In each of these geographic divisions, however, the death-rate was increased materially by the excessive mortality in April, 1906, resulting from a seismic disturbance.

The rate is below the State average, 15.1, not only for the coast and interior counties of Northern California, but also for the bay counties other than San Francisco (Alameda, Contra Costa, Marin and San Mateo), as well as for the interior counties of Central California, extending from Yolo, Sacramento and El Dorado on the north, to and including Kern on the south. The death-rate is 14.5 for the bay counties other than San Francisco and 14.4 for the group of interior counties just described.

For Northern and Central California together the death-rate is only 14.4, as compared with 17.9 for Southern California. The rate for the coast counties from Del Norte to San Luis Obispo inclusive is 15.0, against 13.3 for the interior counties from Siskiyou and Modoc to and including Kern. That the death-rate is higher for the coast than for the interior counties is due mainly to the relatively great mortality usual in a metropolis like San Francisco. Thus, the death-rate is 15.2 for the metropolitan area, comprising San Francisco and the other bay counties, against only 13.6 for the rural counties of Northern and Central California.

Causes of Death.—The following table gives the number of deaths in California in 1905–1906 from certain principal causes, as well as the proportion from each cause per 1,000 total deaths and also the death-rate per 100,000 estimated population (1,784,521):

TABLE 2.—Deaths from Certain Principal Causes, with Proportion per 1,000 Total Deaths and Death-rate per 100,000 Population, for California: 1905–1906.

Cause of Death.	Deaths: 1905–1906.	Proportion per 1,000 Total Deaths.	Death- rate per 100,000 Pop- ulation.
ALL CAUSES	27,028	1,000.0	1,514.5
Typhoid fever	425	15.7	23.8
Malarial fever	90	3.3	5.0
Smallpox	27	1.0	1.5
Measles	128	4.7	7.2
Scarlet fever	45	1.7	2.5
Whooping-cough	174	6.4	9.8
Diphtheria and croup	234	8.7	13.1
Influenza	217	8.0	12.2
Other epidemic diseases	193	7.2	10.8
Tuberculosis of lungs	3,622	134.0	203.0
Tuberculosis of other organs	561	20.8	31.4
Cancer	1,428	52.8	80.0
Other general diseases	1,020	37.7	57.2
Meningitis	448	16.6	25.1
Other diseases of nervous system	2,190	81.0	122.7
Diseases of circulatory system	3,413	126.3	191.3
Pneumonia and broncho-pneumonia	2,153	79.7	120.6
Other diseases of respiratory system	767	28.4	43.0
Diarrhea and enteritis, under 2 years	700	25.9	39.2
Diarrhea and enteritis, 2 years and over	278	10.3	15.6
Other diseases of digestive system	1,427	52.8	80.0
Bright's disease and nephritis	1,407	52.1	78.8
Childbirth	262	9.7	14.7
Early infancy	851	31.5	47.7
Suicide	474	17.5	26.6
Earthquake and fire	709	26.2	39.7
Other violence	1,955	72.3	109.6
All other causes	1,828	67.7	102.4

Tuberculosis is the principal cause of death in California. Over one seventh (15.5 per cent) of all deaths were due to this disease, 13.4 per cent of all deaths being caused by tuberculosis of the lungs and 2.1 per cent by tuberculosis of other organs. The death-rate is 234.4 per 100,000 population for all forms of tuberculosis.

Next to tuberculosis come diseases of the circulatory system, heart disease, etc. These diseases caused one eighth (12.6 per cent) of all deaths and have a death-rate of 191.3 per 100,000 population.

Next come diseases of the respiratory system, which caused nearly one ninth (10.8 per cent) of all deaths in the State, pneumonia and broncho-pneumonia causing 8.0 per cent and other diseases of the respiratory system 2.8 per cent of all deaths. The death-rate for all diseases of the respiratory system is 163.6 per 100,000 population.

Following pneumonia and other diseases of the respiratory system come meningitis and other diseases of the nervous system. These diseases caused nearly one tenth (9.8 per cent) of all deaths and have a death-rate of 147.8 per 100,000 population.

The proportions are next highest for diseases of the digestive system (diarrhea and enteritis, etc.), 8.9 per cent; violence other than suicide or earthquake and fire, 7.2 per cent; cancer, 5.3 per cent; Bright's disease and nephritis, 5.2 per cent; and early infancy, 3.2 per cent.

Of the epidemic diseases, typhoid fever was by far the most fatal, causing 425 deaths, or 1.6 per cent of the State total for the year. The number of deaths from other important epidemic diseases in 1905-1906 was as follows: diphtheria and croup, 234; influenza, 217; whooping-cough, 174; measles, 128; malarial fever, 90; scarlet fever, 45; and smallpox, 27. The deaths from smallpox were only 1 in each 1,000 from all causes and represent a death-rate of no more than 1.5 per 100,000 population.

Altogether, 709 deaths, or 2.6 per cent of all for the year 1905-1906, are charged against the earthquake and fire of April, 1906. The number given includes only the deaths known to have resulted from this public calamity, and may perhaps understate the loss of life resulting from this seismic disturbance. However, the total does include several deaths resulting only indirectly from earthquake and fire, as deaths of aged persons from fright or heart disease and deaths of infants from exposure.

The 709 deaths resulting directly or indirectly from earthquake and fire occurred in the following counties: San Francisco, 463; Santa Clara, 141; Sonoma, 72; Alameda, 12; Santa Cruz, 6; San Benito and Sacramento, 3 each; Mendocino, Napa, and Solano, 2 each; and Glenn, Nevada, and Los Angeles, 1 each. The bulk of the deaths in Santa Clara county were at the State Hospital at Agnews, and nearly all in Sonoma county were in Santa Rosa city. Most of the deaths in the other counties named occurred among refugees from San Francisco suffering from fright or exposure.

Table 3 gives for the three main geographic divisions the number of deaths from certain principal causes, and also the proportion from each cause per 1,000 total deaths. The death-rates for each disease per 100,000 population are not shown for geographic divisions, because the registration of deaths was not equally complete throughout the State.

TABLE 3.—Deaths from Certain Principal Causes, with Proportion per 1,000 Total Deaths, for Main Geographic Divisions: 1905-1906.

Cause of Death.	The State.	Division.		
		Northern.	Central.	Southern.
DEATHS: 1905-1906.				
ALL CAUSES	27,026	3,093	16,720	7,213
Typhoid fever.....	425	55	278	92
Malarial fever.....	90	39	41	10
Smallpox.....	27	4	22	1
Measles.....	128	7	69	52
Scarlet fever.....	45	5	29	11
Whooping-cough.....	174	34	87	53
Diphtheria and croup.....	234	31	132	71
Influenza.....	217	50	102	65
Other epidemic diseases.....	193	40	107	46
Tuberculosis of lungs.....	3,622	309	1,893	1,420
Tuberculosis of other organs.....	561	56	358	147
Cancer.....	1,428	136	903	389
Other general diseases.....	1,020	121	638	261
Meningitis.....	448	46	284	118
Other diseases of nervous system.....	2,190	347	1,265	578
Diseases of circulatory system.....	3,413	344	2,282	787
Pneumonia and broncho-pneumonia.....	2,153	250	1,405	498
Other diseases of respiratory system.....	767	92	479	196
Diarrhea and enteritis, under 2 years.....	700	47	487	166
Diarrhea and enteritis, 2 years and over.....	278	24	185	69
Other diseases of digestive system.....	1,427	173	897	357
Bright's disease and nephritis.....	1,407	115	864	428
Childbirth.....	262	27	166	69
Early infancy.....	851	62	553	236
Suicide.....	474	49	317	108
Earthquake and fire.....	709	78	630	1
Other violence.....	1,955	255	1,140	560
All other causes.....	1,828	297	1,107	424
PROPORTION PER 1,000 TOTAL DEATHS.				
ALL CAUSES	1,000.0	1,000.0	1,000.0	1,000.0
Typhoid fever.....	15.7	17.8	16.6	12.8
Malarial fever.....	3.3	12.6	2.5	1.4
Smallpox.....	1.0	1.3	1.3	0.1
Measles.....	4.7	2.3	4.1	7.2
Scarlet fever.....	1.7	1.6	1.7	1.5
Whooping-cough.....	6.4	11.0	5.2	7.4
Diphtheria and croup.....	8.7	10.0	7.9	9.8
Influenza.....	8.0	16.2	6.1	9.0
Other epidemic diseases.....	7.2	12.9	6.4	6.4
Tuberculosis of lungs.....	134.0	99.9	113.2	196.9
Tuberculosis of other organs.....	20.8	18.1	21.4	20.4
Cancer.....	52.8	44.0	54.0	53.9
Other general diseases.....	37.7	39.1	38.2	36.2
Meningitis.....	16.6	14.9	17.0	16.4
Other diseases of nervous system.....	81.0	112.2	75.7	80.1
Diseases of circulatory system.....	126.3	111.2	136.5	109.1
Pneumonia and broncho-pneumonia.....	79.7	80.8	84.0	69.0
Other diseases of respiratory system.....	28.4	29.8	28.6	27.2
Diarrhea and enteritis, under 2 years.....	25.9	15.2	29.1	23.0
Diarrhea and enteritis, 2 years and over.....	10.3	7.8	11.1	9.6
Other diseases of digestive system.....	52.8	55.9	53.6	49.5
Bright's disease and nephritis.....	52.1	37.2	51.7	59.3
Childbirth.....	9.7	8.7	9.9	9.6
Early infancy.....	31.5	20.1	33.1	32.7
Suicide.....	17.5	15.8	19.0	15.0
Earthquake and fire.....	26.2	25.2	37.7	0.1
Other violence.....	72.3	82.4	68.2	77.6
All other causes.....	67.7	96.0	66.2	58.8

Table 3 shows that the various epidemic diseases cause rather large proportions of all deaths in Northern California, the proportion for this division being higher than the State average in the case of every epidemic disease except measles and scarlet fever. In Northern California, also, the proportion is high for diseases of the nervous system other than meningitis, being 112.2 here against a general average of only 81.0. Central California excels particularly in the proportion of all deaths caused by diseases of the circulatory system (heart disease, etc.), the proportion for such diseases per 1,000 total deaths being 136.5 for this division, against only 126.3 for the State. Southern California leads especially in the proportion of all deaths due to tuberculosis, the proportion for tuberculosis of the lungs being 196.9 per 1,000 total deaths for the seven counties south of Tehachapi, as compared with only 134.0 for the State as a whole. In Southern California, too, the proportion is high for measles, being 7.2 here against a State average of 4.7 per 1,000 total deaths.

Table 4 presents similar figures for the eight minor geographic divisions.

TABLE 4.—Deaths from Certain Principal Causes, with Proportion per 1,000 Total Deaths, for Minor Geographic Divisions: 1905-1906.

Cause of Death.	The State	Northern California.		Central California.				Southern California.	
		Coast Counties.	Interior Counties.	San Francisco	Other Bay Counties.	Coast Counties.	Interior Counties.	Los Angeles.	Other Counties.
DEATHS: 1905-1906.									
ALL CAUSES	27,026	1,457	1,636	7,010	3,133	2,176	4,401	4,638	2,575
Typhoid fever	425	19	36	83	37	33	125	59	33
Malarial fever	90	4	35	6	2	3	30	5	5
Smallpox	27	1	3	11	5	—	6	1	—
Measles	128	5	2	38	15	4	12	39	13
Scarlet fever	45	2	3	10	7	2	10	9	2
Whooping-cough	174	14	20	30	24	19	14	34	19
Diphtheria and croup	234	12	19	49	29	18	36	48	23
Influenza	217	19	31	27	17	25	33	32	33
Other epidemic diseases	193	18	22	45	16	13	33	30	16
Tuberculosis of lungs	3,622	156	153	792	303	262	536	934	486
Tuberculosis of other organs	561	35	21	147	69	50	92	97	50
Cancer	1,428	69	67	380	189	118	216	278	111
Other general diseases	1,020	45	76	275	109	67	187	183	78
Meningitis	448	22	24	110	67	26	81	68	50
Other diseases of nervous system	2,190	220	127	414	245	221	385	319	259
Diseases of circulatory system	3,413	152	192	1,052	448	271	511	542	245
Pneumonia and bronchopneumonia	2,153	107	143	649	281	131	344	343	155
Other diseases of respiratory system	767	42	50	213	102	61	108	136	60
Diarrhea and enteritis, under 2 years	700	21	26	215	103	57	112	99	67
Diarrhea and enteritis, 2 years and over	278	14	10	52	36	33	64	45	24
Other diseases of digestive system	1,427	72	101	379	175	99	244	256	101
Bright's disease and nephritis	1,407	53	62	388	201	110	165	281	147
Childbirth	262	9	18	50	34	34	48	44	25
Early infancy	851	22	40	244	120	43	146	175	61
Suicide	474	26	23	160	59	39	59	76	32
Earthquake and fire	709	76	2	463	12	150	5	1	—
Other violence	1,955	94	161	372	217	136	415	284	276
All other causes	1,828	128	169	356	211	151	389	220	204

TABLE 4.—Deaths from Certain Principal Causes, with Proportion per 1,000 Total Deaths, for Minor Geographic Divisions: 1905-1906—Continued.

Cause of Death.	The State	Northern California.		Central California.				Southern California.	
		Coast Counties.	Interior Counties.	San Francisco	Other Bay Counties.	Coast Counties.	Interior Counties.	Los Angeles.	Other Counties.
PROPORTION PER 1,000 TOTAL DEATHS.									
ALL CAUSES	1,000.0	1,000.0	1,000.0	1,000.0	1,000.0	1,000.0	1,000.0	1,000.0	1,000.0
Typhoid fever	15.7	13.0	22.0	11.8	11.8	15.2	28.4	12.7	12.8
Malarial fever	3.3	2.8	21.4	0.9	0.6	1.4	6.8	1.1	2.0
Smallpox	1.0	0.7	1.8	1.6	1.6	1.4	0.2	—	—
Measles	4.7	3.4	1.2	5.4	4.8	1.8	2.7	8.4	5.1
Scarlet fever	1.7	1.4	1.8	1.4	2.2	0.9	2.3	1.9	0.8
Whooping-cough	6.4	9.6	12.2	4.3	7.7	8.7	3.2	7.3	7.4
Diphtheria and croup	8.7	8.2	11.6	7.0	9.3	8.3	8.2	10.4	8.9
Influenza	8.0	13.0	19.0	3.8	5.4	11.5	7.5	6.9	12.8
Other epidemic diseases	7.2	12.4	13.4	6.4	5.1	6.0	7.5	6.5	6.2
Tuberculosis of lungs	134.0	107.1	93.5	113.0	96.7	120.4	121.8	201.4	188.7
Tuberculosis of other organs.	20.8	24.0	12.8	21.0	22.0	23.0	20.9	20.9	19.4
Cancer	52.8	47.4	41.0	54.2	60.3	54.2	49.1	59.9	43.1
Other general diseases	37.7	30.9	46.5	39.2	34.8	30.8	42.5	39.5	30.3
Meningitis	16.6	15.1	14.7	15.7	21.4	11.9	18.4	14.7	19.4
Other diseases of nervous system	81.0	151.0	77.6	59.1	78.2	101.6	87.5	68.8	100.6
Diseases of circulatory system	126.3	104.3	117.4	150.1	143.0	124.5	116.1	116.9	95.2
Pneumonia and broncho-pneumonia	79.7	73.4	87.4	92.6	89.7	60.2	78.2	74.0	60.2
Other diseases of respiratory system	28.4	28.8	30.6	30.4	32.6	28.0	23.4	29.3	23.3
Diarrhea and enteritis, under 2 years	25.9	14.4	15.9	30.7	32.9	26.2	25.5	21.3	26.0
Diarrhea and enteritis, 2 years and over	10.3	9.6	6.1	7.4	11.5	15.2	14.6	9.7	9.3
Other diseases of digestive system	52.8	49.4	61.7	54.1	55.9	45.5	55.4	55.2	39.2
Bright's disease and nephritis	52.1	36.4	37.9	55.3	64.2	50.6	37.5	60.6	57.1
Childbirth	9.7	6.2	11.0	7.1	10.8	15.6	10.9	9.5	9.7
Early infancy	31.5	15.1	24.5	34.8	38.3	19.8	33.2	37.7	23.7
Suicide	17.5	17.8	14.1	22.8	18.8	17.9	13.2	16.4	12.4
Earthquake and fire	26.2	52.2	1.2	66.0	3.8	68.9	1.1	0.2	—
Other violence	72.3	64.5	98.4	53.1	69.3	62.5	94.3	61.2	107.2
All other causes	67.7	87.9	103.3	50.8	67.3	69.4	88.4	47.4	79.2

It appears from Table 4 that the coast counties of Northern California have a very high proportion of deaths due to diseases of the nervous system other than meningitis. This is accounted for by the fact that many of the deaths reported for this geographic division occurred at the Mendocino and Napa State Hospitals.

The interior counties of Northern California have high proportions for various epidemic diseases. Thus, the proportion for this division as compared with the average for the State is 21.4 against 3.3 for malarial fever, 19.0 against 8.0 for influenza, 12.2 against 6.4 for whooping-cough, 22.0 against 15.7 for typhoid fever, and 11.6 against 8.7 for diphtheria and croup.

In San Francisco the proportion is particularly high for diseases of the circulatory system, being 150.1 here against 126.3 for the State. The proportions for San Francisco are also considerably above the State averages for pneumonia and broncho-pneumonia, 92.6 against 79.7; for diarrhea and enteritis among children under 2 years of age, 30.7 against 25.9; and for suicide, 22.8 for the metropolis, against 17.5 for the State.

In the other bay counties, as in the metropolis itself, the proportion of all deaths caused by disease of the circulatory system is very

being 143.0 for this group of suburban counties, against only 126.3 for the State as a whole.

The coast counties of Central California, like the coast counties of Northern California, have a high proportion for diseases of the nervous system other than meningitis (101.6 against 81.0), and the explanation is that the returns for this division include numerous deaths at the Agnews State Hospital.

The interior counties of Central California, like the interior counties of Northern California, have high proportions for certain epidemic diseases. The proportion of all deaths caused by malarial fever is 6.8 for this division, against 3.3 for the State, and the proportion due to typhoid fever is 28.4 for the division, against 15.7 for the State.

Los Angeles has a very high proportion of deaths due to tuberculosis of the lungs. The proportion for Los Angeles is no less than 201.4, as compared with only 134.0 for the State. Los Angeles also has a high proportion for measles and for diphtheria and croup, the proportions being 8.4 and 10.4 for the county, against 4.7 and 8.7, respectively, for the entire State.

The other six counties south of Tehachapi likewise have a high proportion for tuberculosis of the lungs, 188.7 against 134.0, as well as for diseases of the nervous system other than meningitis, 100.6 against 81.0. As for the coast counties of Northern and Central California, so for the counties of Southern California, the high proportion for nervous diseases is explained by the inclusion of deaths at State hospitals. The very high proportions of all deaths caused by tuberculosis both in Los Angeles and the other counties south of Tehachapi are accounted for by the great number of newcomers from Eastern states who succumb to the "great white plague" even after they reach the Land of Sunshine.

Tuberculosis.—Table 5 brings out sharply the contrasts between different parts of the State in the mortality from tuberculosis.

TABLE 5.—*Number and Per Cent of Total Deaths from Tuberculosis and All Other Causes, for Geographic Divisions: 1905-1906.*

Geographic Division.	Total Deaths: 1905-1906.	Tuberculosis.		All Other Causes.	
		Number.	Per Cent	Number.	Per Cent.
THE STATE	27,026	4,183	15.5	22,843	84.5
Northern California	3,093	365	11.8	2,728	88.2
Coast counties	1,457	191	13.1	1,266	86.9
Interior counties	1,636	174	10.6	1,462	89.4
Central California	16,720	2,251	13.5	14,469	86.5
San Francisco	7,010	939	13.4	6,071	86.6
Other bay counties	3,133	372	11.9	2,761	88.1
Coast counties	2,176	312	14.3	1,864	85.7
Interior counties	4,401	628	14.3	3,773	85.7
Southern California	7,213	1,567	21.7	5,646	78.3
Los Angeles	4,638	1,031	22.2	3,607	77.8
Other counties	2,575	536	20.8	2,039	79.2
Northern and Central California	19,813	2,616	13.2	17,197	86.8
Coast counties	13,776	1,814	13.2	11,962	86.8
Interior counties	6,037	802	13.3	5,235	86.7
Metropolitan area	10,143	1,311	12.9	8,832	87.1
Rural counties	9,670	1,305	13.5	8,365	86.5

It appears from this table that the 4,183 deaths from tuberculosis in California are 15.5 per cent, or over one seventh, of the total 27,026, reported in 1905-1906. The per cent of total deaths caused by tuberculosis is no less than 22.2 for Los Angeles and 20.8 for the other six counties south of Tehachapi. The per cent is below the State average, 15.5, for every geographic division north of Tehachapi. It is as low as 11.9 for the bay counties other than San Francisco, and only 10.6 for the interior counties of Northern California.

However, it must be remembered that deaths of newly arrived consumptives are much more numerous in Southern California than in the rest of the State. This appears clearly from Table 6, showing the length of residence in California of those who died of tuberculosis in 1905-1906.

TABLE 6.—Deaths from Tuberculosis classified by Length of Residence in California, with Per Cent Distribution, for Geographic Divisions: 1905-1906.

Geographic Division.	Total.	Length of Residence.				
		Under 1 Year.	1 to 9 Years.	10 Years and Over.	Life.	Unknown.
NUMBERS.						
THE STATE.....	4,183	557	831	1,188	1,187	420
Northern California.....	365	15	40	123	136	51
Coast counties.....	191	6	20	62	72	31
Interior counties.....	174	9	20	61	64	20
Central California.....	2,251	106	315	759	830	241
San Francisco.....	939	31	108	336	342	122
Other bay counties.....	372	15	53	135	142	27
Coast counties.....	312	22	51	73	150	16
Interior counties.....	628	38	103	215	196	76
Southern California.....	1,567	436	476	306	221	128
Los Angeles.....	1,031	278	342	195	125	91
Other counties.....	536	158	134	111	96	37
Northern and Central Cali- fornia.....	2,616	121	355	882	966	292
Coast counties.....	1,814	74	232	606	706	196
Interior counties.....	802	47	123	276	260	96
Metropolitan area.....	1,311	46	161	471	484	149
Rural counties.....	1,305	75	194	411	482	143
PER CENTS.						
THE STATE.....	100.0	13.3	19.9	28.4	28.4	10.0
Northern California.....	100.0	4.1	10.9	33.7	37.3	14.0
Coast counties.....	100.0	3.1	10.5	32.5	37.7	16.2
Interior counties.....	100.0	5.2	11.5	35.0	36.8	11.5
Central California.....	100.0	4.7	14.0	33.7	36.9	10.7
San Francisco.....	100.0	3.3	11.5	35.8	36.4	13.0
Other bay counties.....	100.0	4.0	14.2	36.3	38.2	7.3
Coast counties.....	100.0	7.1	16.3	23.4	48.1	5.1
Interior counties.....	100.0	6.1	16.4	34.2	31.2	12.1
Southern California.....	100.0	27.8	30.4	19.5	14.1	8.2
Los Angeles.....	100.0	27.0	33.2	18.9	12.1	8.8
Other counties.....	100.0	29.5	25.0	20.7	17.9	6.9
Northern and Central Cali- fornia.....	100.0	4.6	13.6	33.7	36.9	11.2
Coast counties.....	100.0	4.1	12.8	33.4	38.9	10.8
Interior counties.....	100.0	5.9	15.3	34.4	32.4	12.0
Metropolitan area.....	100.0	3.5	12.3	35.9	36.9	11.4
Rural counties.....	100.0	5.7	14.9	31.5	36.9	11.0

Table 6 shows that 27.8 per cent of those who died of tuberculosis in Southern California had lived in the State less than a year, the per cent being 27.0 for Los Angeles and even 29.5 for the other six counties. The corresponding figure for Northern and Central California together is only 4.6, and that for the entire State is 13.3 per cent.

In fact, many of the tuberculosis victims in Southern California had been in the State only a few months. This is shown clearly by the following tabular statement, giving the length of residence in months of those who died of tuberculosis in Los Angeles and the other counties of Southern California after having been in the State less than a year:

Geographic Division.	Total Under 1 Year.	Length of Residence.			
		Under1 Month.	1 to 2 Months.	3 to 5 Months.	6 to 11 Months.
NUMBERS.					
<i>Southern California</i>	436	55	114	120	147
Los Angeles	278	36	66	82	94
Other counties	158	19	48	38	53
PER CENTS.					
<i>Southern California</i>	27.8	3.5	7.3	7.6	9.4
Los Angeles	27.0	3.5	6.4	8.0	9.1
Other counties	29.5	3.5	9.0	7.1	9.9

It appears from the preceding tabular statement that of all who died of tuberculosis in Southern California 3.5 per cent had been in the State less than a month, altogether 10.8 per cent less than three months, and altogether 18.4 per cent less than six months. In Los Angeles 17.9 per cent, and in the other counties 19.6 per cent, of the total victims of tuberculosis had lived in California less than half a year.

Referring again to Table 6, one finds that while in Southern California altogether 58.2 per cent of all tuberculosis victims had lived in the State less than 10 years, in Northern and Central California together only 18.2 per cent had lived here this length of time, the per cent for the whole State being 33.2.

Native Californians form a considerable proportion of all who succumb to tuberculosis in Northern and Central California. Thus, the per cent of native Californians among all who died of tuberculosis is 37.3 for Northern California, and 36.9 for Central California, as compared with 28.4 for the entire State, and only 14.1 for Southern California.

Similarly, deaths of old-time residents from tuberculosis are relatively more numerous north than south of Tehachapi. The per cent of tuberculosis victims who had lived here at least ten years is 33.7 for both Northern and Central California, against 19.5 for Southern California and an average of 28.4 for the whole State.

Sex.—The proportion of the sexes among decedents is given in the following table for the several geographic divisions:

TABLE 7.—Deaths classified by Sex, with Per Cent Distribution, for Geographic Divisions: 1905-1906.

Geographic Division.	Total.	Male.	Female.	Per Cent.	
				Male.	Female.
THE STATE	27,026	16,681	10,345	61.7	38.3
Northern California	3,093	2,059	1,034	66.6	33.4
Coast counties	1,457	942	515	64.7	35.3
Interior counties	1,636	1,117	519	68.3	31.7
Central California	16,720	10,308	6,412	61.7	38.3
San Francisco	7,010	4,364	2,646	62.3	37.7
Other bay counties	3,133	1,803	1,330	57.5	42.5
Coast counties	2,176	1,302	874	59.8	40.2
Interior counties	4,401	2,839	1,562	64.5	35.5
Southern California	7,213	4,314	2,899	59.8	40.2
Los Angeles	4,638	2,725	1,913	58.8	41.2
Other counties	2,575	1,589	986	61.7	38.3
Northern and Central California	19,813	12,367	7,446	62.4	37.6
Coast counties	13,776	8,411	5,365	61.1	38.9
Interior counties	6,037	3,956	2,081	65.5	34.5
Metropolitan area	10,143	6,167	3,976	60.8	39.2
Rural counties	9,670	6,200	3,470	64.1	35.9

Table 7 shows that of the 27,026 persons who died in California in 1905-1906, 16,681, or 61.7 per cent, were male, and 10,345, or 38.3 per cent, were female. The per cent male is highest for the interior and coast counties of Northern California, 68.3 and 64.7 respectively, followed by the interior counties of Central California, 64.5, and by San Francisco, 62.3. The per cent male is below the State average, 61.7, for the remaining geographic divisions, and is lowest of all, 58.8, for Los Angeles.

Race.—The race distribution of decedents appears in Table 8, below:

TABLE 8.—Deaths classified by Race, with Per Cent Distribution, for Geographic Divisions: 1905-1906.

Geographic Division.	Total.	White.	Negro.	Indian.	Chinese.	Japanese.
NUMBERS.						
THE STATE	27,026	25,463	400	113	731	319
Northern California	3,093	2,908	29	56	82	18
Coast counties	1,457	1,386	5	32	22	12
Interior counties	1,636	1,522	24	24	60	6
Central California	16,720	15,666	190	35	576	253
San Francisco	7,010	6,588	51	3	296	72
Other bay counties	3,133	3,001	60	6	43	23
Coast counties	2,176	2,079	14	6	41	36
Interior counties	4,401	3,998	65	20	196	122
Southern California	7,213	6,889	181	22	73	48
Los Angeles	4,638	4,405	149	—	49	35
Other counties	2,575	2,484	32	22	24	13
Northern and Central California	19,813	18,574	219	91	658	271
Coast counties	13,776	13,054	130	47	402	143
Interior counties	6,037	5,520	89	44	256	128
Metropolitan area	10,143	9,589	111	9	339	95
Rural counties	9,670	8,985	108	82	319	176

TABLE 8.—Deaths classified by Race, with Per Cent Distribution, for Geographic Divisions: 1905-1906—Continued.

Geographic Division.	Total.	White.	Negro.	Indian.	Chinese.	Japanese.
PER CENTS.						
THE STATE.....	100.0	94.2	1.5	0.4	2.7	1.2
Northern California.....	100.0	94.0	0.9	1.8	2.7	0.6
Coast counties.....	100.0	95.1	0.4	2.2	1.5	0.8
Interior counties.....	100.0	93.0	1.5	1.5	3.7	0.3
Central California.....	100.0	93.7	1.1	0.2	3.5	1.5
San Francisco.....	100.0	94.0	0.7	0.1	4.2	1.0
Other bay counties.....	100.0	95.8	1.9	0.2	1.4	0.7
Coast counties.....	100.0	95.5	0.6	0.3	1.9	1.7
Interior counties.....	100.0	90.9	1.5	0.4	4.4	2.8
Southern California.....	100.0	95.5	2.5	0.3	1.0	0.7
Los Angeles.....	100.0	95.0	3.2	---	1.1	0.7
Other counties.....	100.0	96.5	1.2	0.9	0.9	0.5
Northern and Central California.....	100.0	93.8	1.1	0.4	3.2	1.4
Coast counties.....	100.0	94.8	1.0	0.3	2.9	1.0
Interior counties.....	100.0	91.5	1.5	0.7	4.2	2.1
Metropolitan area.....	100.0	94.5	1.1	0.1	3.4	0.9
Rural counties.....	100.0	92.9	1.1	0.9	3.3	1.8

The table shows that of the 27,026 decedents, 25,463, or 94.2 per cent, were white; 731, or 2.7 per cent, were Chinese; 400, or 1.5 per cent, were negro; 319, or 1.2 per cent, were Japanese; and 113, or 0.4 per cent, were Indian.

The per cent white is highest, 96.5, for the six counties of Southern California other than Los Angeles, and next, 95.8, for the bay counties other than San Francisco. It is lowest, only 90.9, for the interior counties of Central California.

The per cent Chinese is highest, 4.4, for the interior counties of Central California; next, 4.2, for San Francisco; and next, 3.7, for the interior counties of Northern California. The per cent is below the State average, 2.7, for the remaining geographic divisions, and is especially low, 1.1 and 0.9 respectively, for Los Angeles and the other counties south of Tehachapi.

The per cent Japanese is highest, 2.8, for the interior counties of Central California, and is below the State average, 1.2, for every other minor geographic division.

The per cent negro is highest, 3.2, for Los Angeles, and is equal to the State average, 1.5, only for the interior counties of Northern and Central California besides.

The per cent Indian is highest, 2.2 and 1.5 respectively, for the coast and interior counties of Northern California, but is inconsiderable for both Central and Southern California.

Nativity.—Table 9 gives the nativity of the white decedents classified as born in California, born in other states, foreign born, or nativity unknown. The 1,122 of unknown nativity include 328 victims of the earthquake and fire in San Francisco and vicinity in April, 1906.

TABLE 9.—White Decedents classified by Nativity, with Per Cent Distribution, for Geographic Divisions: 1905-1906.

Geographic Division.	Total White Decedents.	Born in California.	Born in Other States.	For'gn Born.	Nativity Unknown.	Per Cent.			
						Born in California.	Born in Other States.	For'gn Born.	Nativity Unknown.
THE STATE	25,463	7,193	8,993	8,155	1,122	28.3	35.3	32.0	4.4
<i>Northern California</i>	2,908	769	1,108	863	168	26.4	38.1	29.7	5.8
Coast counties	1,386	353	514	453	66	25.5	38.1	32.7	4.7
Interior counties	1,522	416	594	410	102	27.3	39.0	27.0	6.7
<i>Central California</i>	15,666	4,949	4,284	5,704	729	31.6	27.3	36.4	4.7
San Francisco	6,588	2,110	1,287	2,745	446	32.0	19.5	41.7	6.8
Other bay counties	3,001	955	882	1,089	75	31.8	29.4	36.3	2.5
Coast counties	2,079	649	682	694	54	31.2	32.8	33.4	2.6
Interior counties	3,998	1,235	1,433	1,176	154	30.9	35.8	29.4	3.9
<i>Southern California</i>	6,889	1,475	3,601	1,588	225	21.4	52.3	23.0	3.3
Los Angeles	4,405	882	2,343	1,028	152	20.0	53.2	23.3	3.5
Other counties	2,484	593	1,258	560	73	23.9	50.7	22.5	2.9
<i>Northern and Central California</i>	18,574	5,718	5,392	6,567	897	30.8	29.0	35.4	4.8
Coast counties	13,054	4,067	3,365	4,981	641	31.1	25.8	38.2	4.9
Interior counties	5,520	1,651	2,027	1,586	256	29.9	36.7	28.7	4.7
Metropolitan area	9,589	3,065	2,169	3,834	521	32.0	22.6	40.0	5.4
Rural counties	8,985	2,653	3,223	2,733	376	29.5	35.9	30.4	4.2

It appears from Table 9 that of the 25,463 white decedents 8,993, or 35.3 per cent, were born elsewhere in the United States than California; 8,155, or 32.0 per cent, were foreign born; 7,193, or 28.3 per cent, were natives of the Golden State; and 1,122, or 4.4 per cent, were of unknown nativity.

The per cent of native Californians among the white decedents is highest, 32.0, for San Francisco, and next, 31.8, for the other bay counties. The per cent is also above the State average, 28.3, for the coast and interior counties of Central California, being 31.2 for the former and 30.9 for the latter. The per cent California born is somewhat below the State average for both the coast and interior counties of Northern California, and is very low indeed for Southern California. In Los Angeles one fifth, 20.0 per cent, of the white decedents were natives of California.

The per cent of white decedents born in other states is highest, 53.2, for Los Angeles, and next, 50.7, for the other counties south of Tehachapi. The per cent is also above the State average, 35.3, for both the coast and interior counties of Northern California, as well as for the interior counties of Central California. In San Francisco less than one fifth, 19.5 per cent, of the white decedents were natives of other states than California.

The per cent foreign-born among white decedents is highest, 41.7, for San Francisco, and next, 36.3, for the other bay counties. The per cent is also above the State average, 32.0, for the coast counties of both Northern and Central California. The per cent foreign-born is lowest in Southern California, being only 23.3 for Los Angeles, and 22.5 for the other six counties.

Age.—Table 10 gives the classification of decedents by selected age periods representing, in a rough way, early infancy, childhood, youth, productive ages, and old age.

TABLE 10.—Deaths classified by Age Periods, with Per Cent Distribution, for Geographic Divisions: 1905-1906.

Geographic Division.	Totals.	Under 1 Year.	1 to 4 Years.	5 to 14 Years.	15 to 64 Years.	65 Yrs. and Over.	Age Un-known.
NUMBERS.							
THE STATE	27,026	2,953	1,212	891	14,213	7,324	433
<i>Northern California</i>	3,063	233	112	119	1,458	1,124	47
Coast counties	1,457	101	49	55	698	524	30
Interior counties	1,636	132	63	64	760	600	17
<i>Central California</i>	16,720	1,938	757	501	8,689	4,474	361
San Francisco	7,010	886	323	172	3,782	1,566	281
Other bay counties	3,133	403	155	107	1,484	972	12
Coast counties	2,176	195	81	71	1,097	692	40
Interior counties	4,401	454	198	151	2,326	1,244	28
<i>Southern California</i>	7,213	782	343	271	4,066	1,726	25
Los Angeles	4,638	511	204	180	2,678	1,049	16
Other counties	2,575	271	139	91	1,388	677	9
<i>Northern and Central California</i>	19,813	2,171	869	620	10,147	5,698	408
Coast counties	13,776	1,585	608	405	7,061	3,754	363
Interior counties	6,037	586	261	215	3,086	1,944	45
Metropolitan area	10,143	1,289	478	279	5,266	2,538	293
Rural counties	9,670	882	391	341	4,881	3,060	115
PER CENTS.							
THE STATE	100.0	10.9	4.5	3.3	52.6	27.1	1.6
<i>Northern California</i>	100.0	7.5	3.6	3.9	47.1	36.4	1.5
Coast counties	100.0	6.9	3.4	3.8	47.9	36.0	2.0
Interior counties	100.0	8.1	3.8	3.9	46.5	36.7	1.0
<i>Central California</i>	100.0	11.6	4.5	3.0	52.0	26.7	2.2
San Francisco	100.0	12.6	4.6	2.5	54.0	22.3	4.0
Other bay counties	100.0	12.9	4.9	3.4	47.4	31.0	0.4
Coast counties	100.0	9.0	3.7	3.3	50.4	31.8	1.8
Interior counties	100.0	10.3	4.5	3.4	52.9	28.3	0.6
<i>Southern California</i>	100.0	10.8	4.8	3.8	56.4	23.9	0.3
Los Angeles	100.0	11.0	4.4	3.9	57.7	22.6	0.4
Other counties	100.0	10.5	5.4	3.5	53.9	26.3	0.4
<i>Northern and Central California</i>	100.0	11.0	4.4	3.1	51.2	28.2	2.1
Coast counties	100.0	11.5	4.4	2.9	51.3	27.3	2.6
Interior counties	100.0	9.7	4.3	3.6	51.1	30.6	0.7
Metropolitan area	100.0	12.7	4.7	2.8	51.9	25.0	2.9
Rural counties	100.0	9.1	4.0	3.5	50.5	31.7	1.2

The table shows that of the 27,026 deaths in California in 1905-1906, 14,213, or 52.6 per cent, occurred at the "productive age" from 15 to 64 years; 7,324, or 27.1 per cent, at the period of old age, 65 years and over; 2,953, or 10.9 per cent, in early infancy or the first year of life; 1,212, or 4.5 per cent, in childhood, 1 to 4 years; 891, or 3.3 per cent, in youth, 5 to 14 years; and 433, or 1.6 per cent, at unknown ages.

The per cent of total deaths occurring in early infancy or the first

year of life is highest, 12.9, for the bay counties other than San Francisco; next, 12.6, for the metropolis itself; and next, 11.0 for Los Angeles. The per cent of all deaths at under 1 year of age is below the State average, 10.9, for the remaining geographic divisions, and is lowest of all, only 6.9, for the coast counties of Northern California.

The per cent of deaths in childhood, 1 to 4 years, is highest, 5.4, for the six counties of Southern California other than Los Angeles, and is also above the State average, 4.5, for San Francisco and the other bay counties. The per cent is lowest, 3.4, for the coast counties of Northern California.

The per cent of deaths in youth, 5 to 14 years, is highest, 3.9, for Los Angeles, and is about the same also, 3.8 and 3.9 respectively, for the coast and interior counties of Northern California. The per cent of deaths occurring at from 5 to 14 years of age is above or equal to the State average, 3.3, for every minor geographic division except only San Francisco, where the per cent is 2.5.

The per cent of deaths occurring at from 15 to 64 years, sometimes called the "productive ages," is highest, 57.7, for Los Angeles; next, 54.0 for San Francisco; and next, 53.9 for the six counties of Southern California other than Los Angeles. The per cent is above the State average, 52.6, only for the interior counties of Central California besides. The per cent of deaths at the productive ages is lowest in Northern California, being 47.9 for the coast counties and only 46.3 for the interior counties.

The per cent of deaths occurring at the period of old age, 65 years and over, is highest in Northern California, being 36.7 for the interior counties and 36.0 for the coast counties. The per cent is much above the State average, 27.1, for the coast counties of Central California as well as for the bay counties other than San Francisco, and is also slightly above the State average for the interior counties of Central California besides. The per cent of deaths occurring at 65 years and over is lowest of all, 22.3, for San Francisco, though it is almost as low, 22.6, for Los Angeles.

36	Syphilis	77	52	26	61	4	1	8	3	44	8	7	2	41	8	1	28	4
37	Gonorrhea of the adult	77	4	2	4	2	2	1	2	2	2	1	1	1	1	1	4	4
38	Gonorrheal infections of children	77	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1
39	Cancer of mouth	54	49	5	53	2	2	1	1	2	24	25	6	1	1	1	28	25
40	Cancer of stomach and liver	560	352	208	54	7	7	4	2	36	217	243	3	1	1	1	311	246
41	Cancer of intestines and peritoneum	103	49	58	102	1	1	1	1	10	37	52	8	1	1	1	62	41
42	Cancer of genital organs	236	110	236	227	6	1	1	1	34	106	86	1	1	1	1	197	89
43	Cancer of breast	110	110	110	110	1	1	1	1	10	53	45	2	1	1	1	81	29
44	Cancer of skin	60	45	59	59	3	1	1	1	1	36	22	1	1	1	1	188	107
45	Cancer of other or unspecified organs	305	196	109	290	3	1	1	1	27	143	119	1	1	1	1	22	49
46	Tumor (noncancerous)	13	5	8	13	2	1	1	1	30	29	25	3	1	1	1	7	5
47	Acute articular rheumatism	90	45	45	87	2	1	1	1	7	5	5	1	1	1	1	22	49
48	Chronic rheumatism and gout	103	50	53	99	3	1	1	1	7	54	36	2	1	1	1	3	54
49	Scurvy	1	1	1	1	1	1	1	1	24	102	66	2	1	1	1	11	119
50	Diabetes	199	105	94	164	4	1	1	1	10	10	5	1	1	1	1	13	2
51	Exophthalmic goiter	16	4	12	16	1	1	1	1	1	1	1	1	1	1	1	7	1
52	Addison's disease	8	6	2	8	1	1	1	1	8	10	9	1	1	1	1	23	3
53	Leukemia	29	20	9	27	1	1	1	1	16	30	14	3	1	1	1	41	16
54	Anemia, chlorosis	63	24	33	63	1	1	1	1	41	70	84	37	1	1	1	203	27
55	Alcoholism	233	199	34	232	5	1	1	1	1	1	3	1	1	1	1	8	2
56	Lead poisoning	5	5	5	5	1	1	1	1	1	1	1	1	1	1	1	1	1
57	Other professional intoxications	71	62	9	42	1	1	1	1	17	14	5	6	1	1	1	62	8
58	Other chronic poisonings	4	3	1	4	1	1	1	1	2	2	1	1	1	1	1	2	2
59	Other general diseases	2,638	1,588	1,050	2,545	34	2	35	22	612	1,016	865	52	223	150	102	1,062	1,065
60	Encephalitis	15	10	5	15	3	7	15	3	301	75	40	1	4	2	65	5	3
61	Meningitis	448	257	101	423	3	1	1	1	7	29	24	1	1	1	1	121	18
62	Locomotor ataxia	59	47	12	78	1	1	1	1	1	1	1	1	1	1	1	41	17
63	Other diseases of spinal cord	78	55	23	78	1	1	1	1	1	1	1	1	1	1	1	33	33
64	Apoplexy	1,071	646	425	1,069	11	1	18	2	60	480	464	25	1	2	7	423	639
65	Softening of brain	93	61	42	93	2	1	4	2	21	138	134	6	1	1	1	96	57
66	Paralysis	288	154	132	268	3	4	4	4	13	138	134	6	1	1	1	73	205
67	General paralysis of insane	112	92	70	109	4	2	2	2	17	84	42	4	4	4	4	93	27
68	Other forms of mental disease	123	75	48	164	4	2	2	2	13	21	23	4	2	2	2	45	21
69	d(p). Other diseases of brain	73	37	36	66	4	2	2	2	13	31	33	1	2	1	7	70	12
70	Epilepsy	92	56	39	92	2	1	1	1	3	39	18	1	1	1	2	6	6
71	Convulsions (nonpuerperal)	8	6	4	8	1	1	1	1	8	5	1	1	1	1	1	2	2
72	Convulsions of children	90	49	47	93	1	2	2	2	22	10	5	1	5	2	13	15	2
73	Tetanus	37	27	10	37	1	1	1	1	2	2	2	1	1	1	2	3	3
74	Chorea	31	1	1	31	1	1	1	1	1	1	1	1	1	1	1	28	7
75	d(p). Other diseases of nervous system	36	13	1	35	1	1	1	1	1	1	1	1	1	1	1	1	1
76	Diseases of the eye and its adnexa	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2
77	Diseases of the ear	5	2	3	4	1	1	1	1	1	1	1	1	1	1	1	1	1
III. DISEASES OF THE CIRCULATORY SYSTEM																		
77	Pericarditis	3,413	2,129	1,284	3,263	47	7	78	18	293	1,426	1,446	98	16	8	65	1,645	1,668
78	Endocarditis	32	20	12	29	2	2	3	3	6	6	15	2	2	2	3	22	7
79	Heart disease	126	63	63	122	1	1	1	1	27	50	43	2	1	3	15	73	33
80	Angina pectoris	2,766	1,727	1,039	2,635	40	5	70	16	224	1,127	1,200	84	9	5	44	1,339	1,361
81	Diseases of arteries	101	62	39	99	1	1	1	1	7	66	29	3	3	3	50	51	51
82	Embolism and thrombosis	259	174	85	253	3	3	8	3	6	121	125	1	1	1	82	177	177
83	Other diseases of circulatory system	78	46	32	77	1	1	1	1	9	41	24	3	1	2	2	48	26

* Indefinite and unsatisfactory title. † Order of titles changed.

TABLE 11.—Deaths from each Specified Disease and Class of Diseases, classified by Sex, Race, Nativity, and Age Periods, for California: 1905-1906.—Cont'd.

No.	Cause of Death.	Total Deaths	Male	Fe- male	White	Ne- gro	In- dian	Chi- nese	Jap- anese	WHITE.				Un- der 1 Year	1 to 4 to 14 Years	15 to 64 Years	65 Years and Over
										Born in Calif. to U.S. States	Born in other foreign countries	Nativity Un- known					
III. DISEASES OF CIR. SYSTEM—Continued.																	
83	Diseases of veins	9	5	4	8			1			7	1				5	4
84	Diseases of lymphatics	4	3	1	3					1	1	1			1	3	
85	Hemorrhages (except of lungs)	38	29	9	37						13	8	3	5		23	9
86	Other diseases of circulatory system																1
IV. DISEASES OF THE RESPIRATORY SYSTEM.																	
87	Diseases of nasal fossæ	2,920	1,791	1,129	2,781	41	8	74	16	854	865	985	77	401	210	80	1,234
88	{(a) Catarrhitis	1	1		1					1	3	3		2	6	4	1
88	{(a) Catarrhitis	18	10	8	18					12	3	3			1	1	3
88	{(a) Catarrhitis	5	3	2	4			1		3	1					2	1
88	{(a) Catarrhitis	3	3	3	3					3	3						3
89	{(b) Other diseases of the throat																
89	{(b) Other diseases of the throat	161	91	70	155	2	1	2	1	90	26	38	1	65	23	5	23
90	Acute bronchitis	248	138	110	243					24	94	123	2	2	3	2	66
91	Chronic bronchitis	427	218	209	406			9	4	188	100	111	7	116	62	11	93
92	Bronchopneumonia	1,726	1,109	617	1,633	27	6	50	10	471	524	586	52	191	105	48	885
93	Pleuritis	69	46	23	56			2	1	6	21	27	2	1	2	1	39
93	Pleuritis	120	71	49	118			1	1	39	36	40	3	21	5	5	29
96	Congestion of lungs	14	9	5	14					3	5	5	1	1	2		8
96	Congestion of lungs	62	36	26	60	1		1		4	26	27	3	1	2		29
97	Asthma	9	6	3	9					5	5	4				1	6
98	Erythema	43	34	9	39	1		3		7	15	12	5	1	1	33	9
99	{(a) Hemorrhage of lungs	24	19	5	22			2		6	6	9	1	1	2	14	7
99	{(b) Other diseases of respiratory system																
V. DISEASES OF THE DIGESTIVE SYSTEM.																	
100	Diseases of mouth	2,405	1,354	1,051	2,303	29	8	39	26	1,103	609	555	36	686	207	95	973
101	{(a) Tonsillitis	7	4	3	7					6	1			6			1
101	{(a) Tonsillitis	26	13	13	25				1	12	10	3		2	6	9	6
102	{(b) Diseases of pharynx	8	4	4	8					5	1			3	1		3
102	{(b) Diseases of pharynx	3	1	2	3					1	1	1		1			2
103	Diseases of esophagus	53	28	25	52					7	28	17		1			40
103	Ulcer of stomach	133	73	60	128	3		2		25	48	53	2	8	3	8	45
104	{(a) Gastritis	66	45	21	63	3				29	24	10		2	6	3	18
104	{(b) Other diseases of stomach	7	3	4	10					10				3	2		19
105	Dentition	700	373	327	681	4	3	2	10	653	24	3	1	584	116	48	103
105	Diarrhea and enteritis (under 2 years)	278	147	131	269	2	1	6		79	104	79	7				105
106	Diarrhea and enteritis (2 years and over)																4
107	Intestinal parasites																
108	{(a) Hernia	66	36	30	61			3		12	19	29	1	7		7	31
108	{(b) Obstruction of intestines	152	77	75	147			1	2	60	43	41	3	32	17	1	58
109	Other diseases of intestines	37	19	18	36	1				9	20	6	1	2	2	1	25
110	Acute yellow atrophy of liver	4	2	2	4					2	2	2		2			7
111	Hydatid tumors of liver	2	2							2	2						2
112	Cirrhosis of liver	321	230	91	299	2	2	14	4	87	84	102	16			1	251

113	Biliary calculi.....	37	17	20	34	1	2	3	18	12	1	8	2	21	16
114	Other diseases of liver.....	135	79	56	127	2	1	8	55	64	8	4	2	86	42
115	Diseases of spleen.....	4	4	3	3	1	1	1	4	8	8	4	11	14	1
116	Peritonitis (nonpuerperal).....	154	68	86	146	3	1	51	64	28	3	8	2	114	8
118	Peritonitis.....	196	120	189	189	3	1	82	60	46	1	1	38	150	8
117	Other diseases of digestive system.....	9	4	6	7	2	2	4	4	8	8	1	1	8	8
VI. DISEASES OF GENITO-URINARY SYSTEM.....															
119	Acute nephritis.....	1,740	1,040	700	1,652	34	3	43	8	645	37	20	8	949	781
120	Bright's disease.....	56	33	54	1	1	22	19	13	13	10	5	6	28	7
121	Other diseases of kidneys.....	1,351	831	520	1,282	24	89	6	152	576	31	8	20	749	568
122	Calculi of urinary tract.....	48	35	13	47	1	1	4	24	16	3	2	22	22	1
123	Diseases of bladder.....	8	5	3	8	3	3	3	4	3	3	8	5	5	3
124	Diseases of urethra, urinary abscess, etc.....	107	92	15	102	1	2	2	3	56	42	1	22	84	1
125	Diseases of prostate.....	44	44	43	43	1	1	1	23	19	1	1	8	35	1
126	Nonvenereal diseases of (male) genital organs.....	6	6	6	6	1	1	1	3	2	2	2	6	2	1
127	Metritis.....	127	6	3	3	3	10	8	2	2	2	2	22	3	3
128	Uterine hemorrhage (nonpuerperal).....	25	31	30	5	5	10	8	2	2	2	8	28	28	3
129	Uterine tumor (noncancerous).....	31	31	30	1	1	13	9	4	4	4	6	14	14	3
130	Other diseases of uterus.....	17	17	16	1	1	6	6	4	4	4	1	40	40	1
131	Ovarian tumors.....	41	41	38	1	1	14	12	11	1	1	2	2	2	2
132	(a) Diseases of tubes.....	2	2	2	2	2	2	2	2	2	2	2	2	2	2
133	(b) Other diseases of female genital organs.....	1	1	1	1	1	1	1	1	1	1	1	1	1	1
133	Nonpuerperal diseases of the breast (cancer excepted).....	262	262	246	262	2	3	8	94	81	71	261	1	261	1
VII. CHILD BIRTH.....															
134	Accidents of pregnancy.....	90	90	85	1	1	4	38	30	17	13	90	13	90	1
135	Puerperal hemorrhage.....	13	13	13	13	1	2	4	8	5	9	16	76	76	1
136	Other accidents of labor.....	17	17	14	1	1	2	23	23	21	4	73	88	88	1
137	Puerperal septicemia.....	73	73	67	33	1	1	14	13	4	10	11	15	36	36
138	Puerperal convulsions.....	33	33	31	31	1	1	10	11	15	15	15	15	15	15
139	Puerperal puerperal accidents.....	36	36	36	36	1	1	1	1	1	1	1	1	1	1
140	Puerperal diseases of the breast.....	262	262	246	262	2	3	8	94	81	71	261	1	261	1
141	Puerperal diseases of the breast.....	262	262	246	262	2	3	8	94	81	71	261	1	261	1
VIII. DISEASES OF THE SKIN.....															
142	Gangrene.....	97	58	39	93	2	1	1	15	40	34	4	1	3	59
143	Carbuncle.....	54	30	24	53	1	4	4	25	21	3	2	7	45	45
*144	Abscess.....	4	2	2	4	1	1	1	2	1	1	1	1	2	1
145	Other diseases of the skin.....	27	18	9	25	1	1	7	8	9	1	1	3	14	8
145	Other diseases of the skin.....	12	8	4	11	1	1	3	5	3	3	8	7	7	5
IX. DISEASES OF THE LOCOMOTOR SYSTEM.....															
146	Diseases of bones.....	35	23	12	32	3	3	11	10	11	8	4	8	17	3
147	Diseases of joints.....	30	18	12	27	8	8	11	8	8	8	4	8	12	3
*148	Amputation.....	4	4	4	4	1	1	1	1	3	4	1	1	1	1
149	Other diseases of organs of locomotion.....	1	1	1	1	1	1	1	1	1	1	1	1	1	1
X. MALFORMATIONS.....															
150	(a) Hydrocephalus.....	181	110	71	175	2	2	2	172	2	1	164	12	8	2
150	(b) Congenital malformation of heart, cyanosis.....	25	16	9	25	25	25	25	25	25	25	16	6	3	1
150	(c) Other congenital malformations.....	126	79	47	121	2	2	1	119	2	1	121	4	4	1
150	(c) Other congenital malformations.....	30	15	15	29	29	29	29	29	29	29	29	29	29	29

* Indefinite and unsatisfactory title. † Order of titles changed.

TABLE 11.—Deaths from each Specified Disease and Class of Diseases, classified by Sex, Race, Nativity, and Age Periods, for California: 1905-1906.—Cont'd.

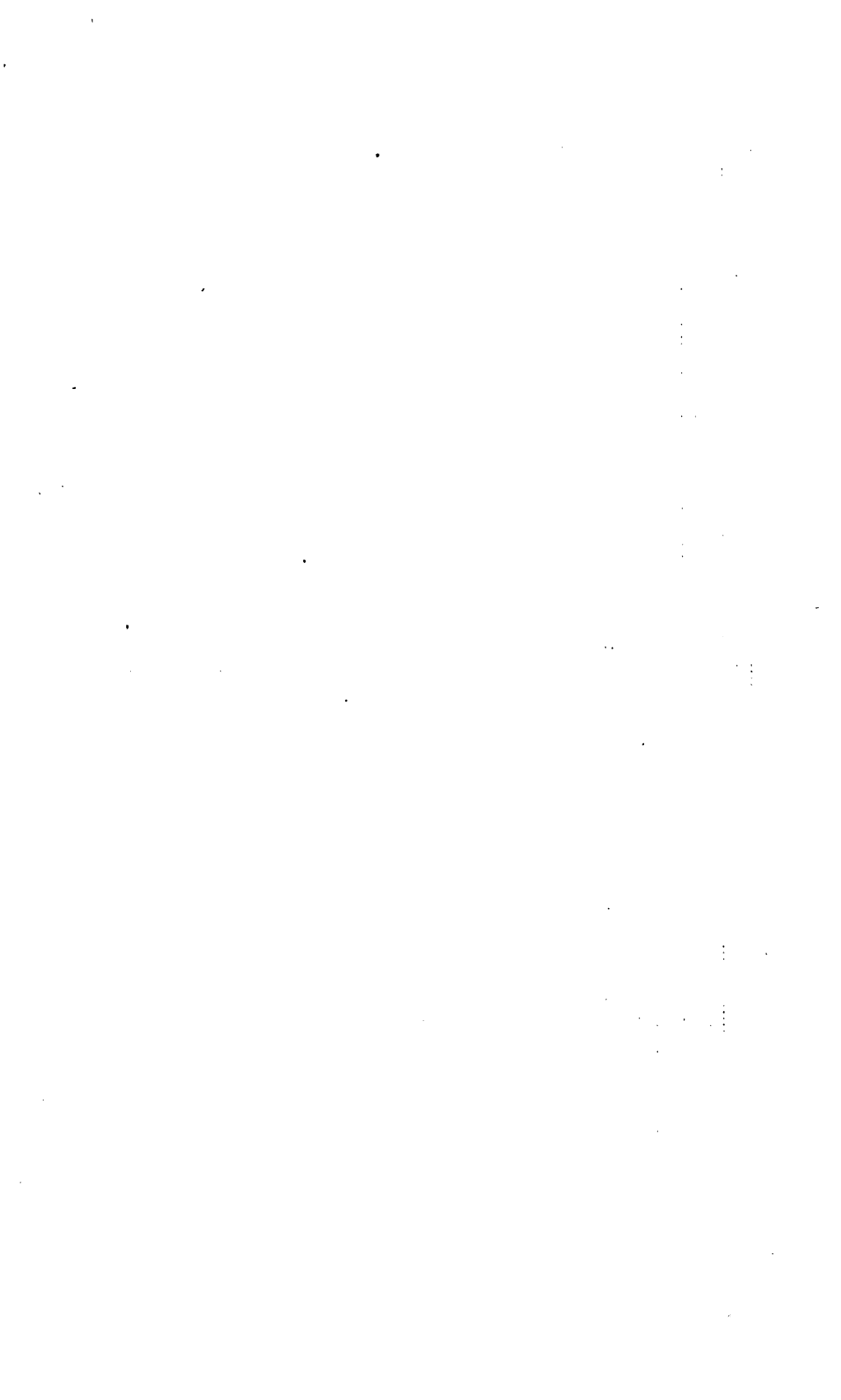
No.	Cause of Death.	Total Deaths	Male	Fe- male	White	Ne- gro	In- dian	Chi- nese	Jap- anese	WHITE.				Un- der 1 Year	1 to 4 Years	5 to 14 Years	15 to 64 Years	65 Years and Over	Age Un- known
										Born in Cal- ifor- nia	Born in other States	For- eign born	Nat- ivity Un- known						
XI. EARLY INFANCY																			
151	(a) Premature birth.....	851	492	359	813	14	2	13	9	813	.....	.....	.....	851	.....	.....	.....	.....	.....
	(*) Congenital debility.....	455	260	195	498	6	1	4	6	498	.....	.....	.....	455	.....	.....	.....	.....	.....
	(b) Other diseases of early infancy	845	198	147	327	7	1	9	1	327	.....	.....	.....	845	.....	.....	.....	.....	.....
	Lack of care.....	33	22	11	32	.....	.....	.....	.....	32	.....	.....	.....	33	.....	.....	.....	.....	.....
153		18	12	6	16	1	.....	.....	.....	16	.....	.....	.....	18	.....	.....	.....	.....	.....
XII. OLD AGE																			
*154	Old age.....	687	396	291	666	7	3	11	.....	4	321	380	11	.....	.....	.....	23	662	2
		687	396	291	666	7	3	11	.....	4	321	380	11	.....	.....	.....	23	662	2
XIII. VIOLENCE																			
155	Suicide by poison.....	3,138	2,552	586	2,959	32	20	85	62	678	804	849	606	119	103	124	2,106	339	347
156	Suicide by asphyxia.....	147	107	40	142	1	.....	3	1	28	36	47	33	.....	2	126	17	2	.....
157	Suicide by hanging or strangulation	48	42	6	48	.....	.....	.....	.....	13	16	12	7	.....	1	44	2	1	.....
158	Suicide by drowning.....	53	44	9	38	1	.....	11	3	3	9	19	7	.....	.....	46	6	1	.....
159	Suicide by firearms.....	15	13	2	14	.....	.....	.....	.....	1	4	2	7	.....	.....	12	8	.....	.....
160	Suicide by cutting instruments	157	146	11	148	2	.....	.....	7	25	52	49	22	.....	.....	143	12	2	.....
161	Suicide by jumping from high places	33	30	3	31	.....	.....	1	1	4	8	15	4	.....	.....	27	6	.....	.....
162	Suicide by crushing.....	3	2	1	3	.....	.....	.....	.....	.....	.....	2	1	.....	.....	.....	.....	.....	.....
163	Other suicides.....	4	3	1	4	.....	.....	.....	.....	1	4	.....	.....	.....	.....	.....	.....	.....	.....
164	Fractures.....	14	10	4	12	.....	.....	.....	.....	1	4	.....	.....	.....	.....	.....	.....	.....	.....
165	Dislocations.....	145	108	37	138	2	.....	.....	1	22	56	68	7	.....	2	3	86	2	.....
*167	Burns and scalds.....	2	2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
168	Burning by corrosive substances.	202	139	63	185	8	2	6	1	57	82	41	5	.....	7	34	15	180	16
169	Heat and sunstroke.....	3	2	1	3	.....	.....	.....	.....	1	.....	.....	.....	.....	.....	.....	.....	.....	.....
170	Cold and freezing.....	44	33	11	40	1	.....	4	.....	14	5	18	3	.....	.....	.....	20	2	1
171	Lightning.....	17	16	1	15	.....	.....	.....	.....	4	.....	.....	.....	.....	.....	.....	7	6	1
172	Drowning.....	33	33	.....	33	.....	.....	.....	.....	10	15	3	5	.....	.....	.....	.....	.....	.....
173	Starvation, privation, etc.....	216	195	21	203	1	3	2	7	63	50	62	38	6	12	23	158	9	8
174	Inhalation of poisonous gases.....	5	5	.....	.....	.....	.....	.....	.....	2	.....	.....	.....	.....	.....	.....	.....	.....	.....
175	Other accidental gunshot wounds	88	68	20	81	1	.....	2	4	17	21	33	10	.....	.....	.....	74	11	1
	(a) Accidental gunshot wounds	97	51	46	93	1	1	1	1	33	37	20	3	.....	6	19	8	87	4
	(c) Injuries by machinery	22	22	.....	.....	2	2	1	.....	1	30	19	6	.....	.....	.....	.....	.....	.....
*166	(c) Injuries in mines and quarries	49	49	.....	49	.....	.....	.....	.....	8	10	22	4	.....	.....	.....	47	1	1
	(c) Railroad accidents and injuries	321	300	21	304	2	1	5	9	45	109	89	61	.....	5	12	271	80	3
	(c) Injuries by horses and vehicles	94	79	15	89	.....	2	1	2	28	27	27	7	.....	3	14	61	16	6
	(c) Other accidental traumas	316	285	31	307	1	1	4	1	60	102	118	27	.....	4	10	16	223	57
	(c) Suffocation.....	21	13	8	19	.....	.....	.....	.....	14	3	2	.....	.....	1	2	6	1	.....
	(c) Injuries at birth.....	53	39	14	51	.....	.....	.....	.....	51	.....	.....	.....	.....	.....	.....	.....	.....	.....
176	(c) Homicide.....	119	98	21	93	1	1	10	4	25	.....	.....	.....	.....	.....	.....	109	5	5
	(c) Other external violence.....	14	14	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	(c) Earthquake and fire	708	513	191	671	1	1	31	7	114	.....	146	328	19	12	16	262	68	314

	495	343	152	429	12	8	37	9	156	125	106	40	116	24	6	194	144	11
XIV. ILL-DEFINED DISEASES																		
"Dropsy".....	13	12	6	17			1		1	9	7					7	11	
Sudden death.....	14	8	6	14					1	6	5	2				4	10	
(a) Heart failure.....	62	47	15	59				3	3	31	22	3	1			30	30	
(b) Inanition (over 3 months)†	62	23	30	50	1			1	37	7	6		32	6		2	6	
(c) Debility (over 3 months)†	15	11	7	16	1		1		11	1	3	1	11	2		2	2	
(d) Marasmus (over 3 months)†	62	23	33	57	2	1	1		51	4	2		49	8		3	2	
(e) Fever.....	2	1	1	1				1			1							
(f) Other ill-defined diseases	25	13	12	24	1	7			7	8	7	2	2		1	13	7	2
(g) Unknown.....	242	200	42	191	7	7	34	3	45	59	55	32	15	7	5	131	76	8

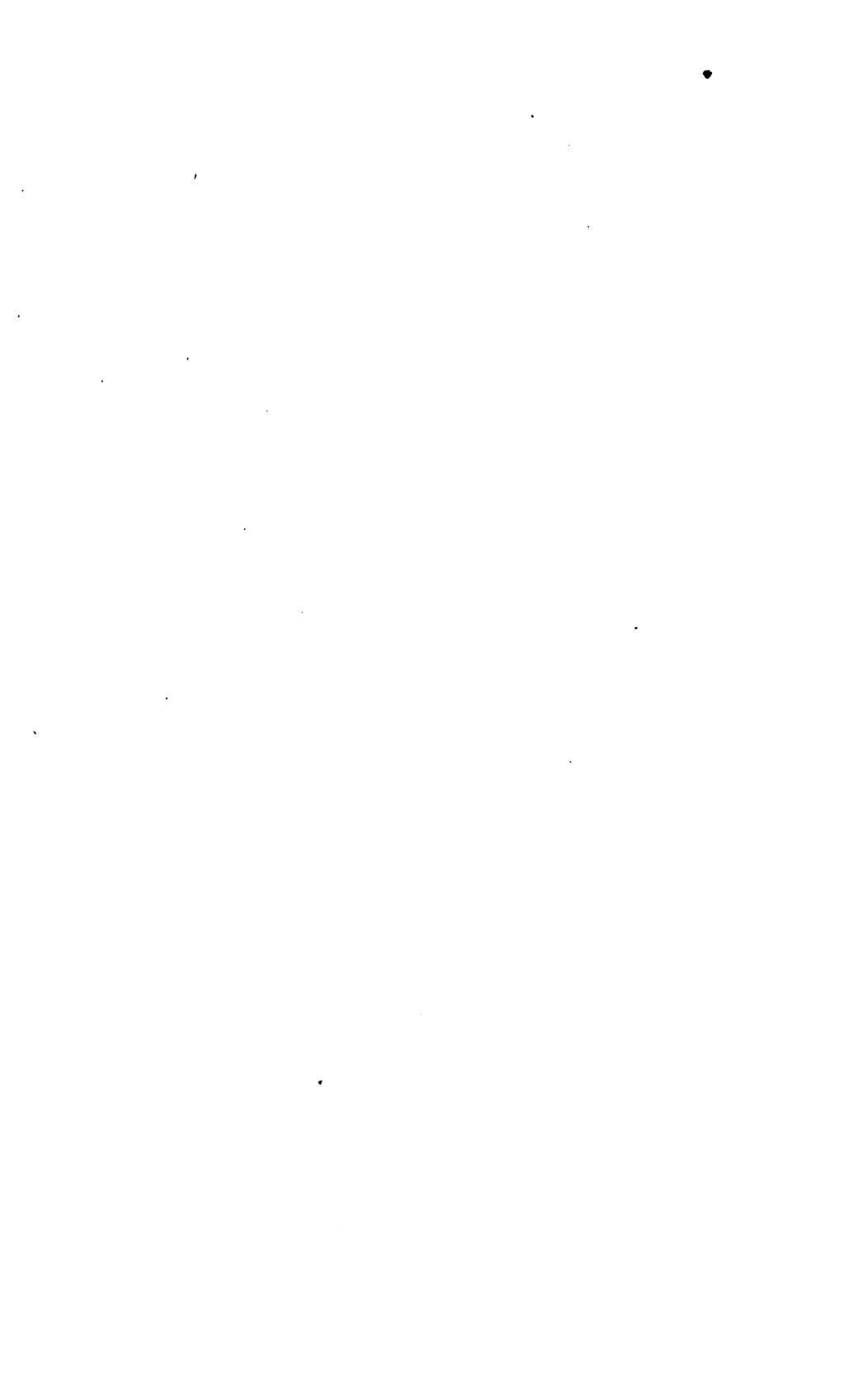
*Indefinite and unsatisfactory title.

†Order of titles changed.

‡Deaths reported from this cause, under 3 months of age, are compiled under "Congenital debility" 151 (b).



STATE HYGIENIC LABORATORY.



REPORT OF THE STATE HYGIENIC LABORATORY.

July 1, 1905, to July 1, 1906.

By ARCHIBALD R. WARD, DIRECTOR,
Assistant Professor of Bacteriology, University of California.

The work of the laboratory, as defined in the legislative Act by which it was established, embraces bacteriological and chemical examinations of a kind to be designated by the State Board of Health. The limited funds available for the support of the laboratory have restricted its activity to only a few of the lines legitimately within its field and for which there is pressing demand. Under instructions from Dr. N. K. Foster, Secretary of the State Board of Health, both routine and research work has been carried on as herein reported.

The dominant idea in equipping and organizing the work of the State Hygienic Laboratory has been to extend to the health officers and physicians in smaller cities and country districts certain laboratory facilities available in the larger cities. To this end, mailing cases, with directions for use, have been prepared and distributed about the State, upon request. Twenty-one towns are supplied with these mailing cases. For the convenience of all concerned, it has been found desirable to deposit the cases in drugstores, where they may be obtained for use by the physician when needed. By this means it is possible for a limited number of outfits to be available for emergency use by the maximum number of physicians. The arrangement is especially desirable for the diphtheria mailing cases, as their contents deteriorate and need to be renewed from time to time.

The distribution of outfits has not been limited to drugstores, nor to health officers, but in numerous instances the cases have been sent directly to such physicians as constantly use them.

The mailing cases are constructed in accordance with regulations of the Postoffice Department governing the transmission of pathological material through the mails. The data cards accompanying the mailing cases for pathological material, etc., from the various diseases, contain on one side blanks for facts to be supplied by the physician, and on the other, blanks for the laboratory record of the material. These cards are uniformly three by five inches, and the blanks for each kind of determination are printed on paper of a distinctive color, as are the circulars of directions, etc.

DIPHTHERIA.

In the control of diphtheria epidemics a laboratory renders valuable assistance. A laboratory report on cultures from the throat is of use in each of the following particulars: (a) early diagnosis of diphtheria, (b) detection of mild cases, (c) differentiating between diphtheria and

tonsillitis, (d) confirmation of positive clinical diagnosis, (e) for determining duration of quarantine after recovery.

The outfit contains a sterile swab, which is to be brought in contact with the suspected throat and afterwards rubbed over the surface of a tube of blood serum. After twelve hours' incubation a microscopic examination is made of the growth. Considerable emphasis is laid upon the necessity for prompt reports on these cultures inoculated at the bedside by the physician. A positive report enables him to apply the antitoxin treatment without the undesirable delay which would be necessitated if he waited for the full development of symptoms upon which to base a clinical diagnosis.

The diphtheria outfits of the laboratory may be sent as first-class mail, when stamped with the necessary postage, eight cents. Care is taken to insure prompt delivery of these cases from the Berkeley post-office. A messenger from the laboratory each evening collects those that have arrived too late for the afternoon delivery, so that they are not delayed over night in the postoffice.

The diphtheria work was undertaken with some idea that the delay during transportation would render the service unsatisfactory to physicians in quarters of the State far distant from Berkeley. Experience has shown the contrary. Diphtheria reports have been of use in an epidemic in Ontario, which town is over five hundred miles distant from Berkeley by rail.

During the year 330 diphtheria culture outfits have been sent in. Sacramento furnished 126, Berkeley 75, Ontario (and Cucamonga) 50, and the rest scattering. The data furnished by the physicians showed that of the 330, 120 were for diagnosis, 115 for release from quarantine, and 95 for confirmation of clinical diagnosis of diphtheria.

Several physicians, who had sent in numerous cultures, were asked for information as to just what use was made of the reports. The replies emphasize the diversity of ways in which laboratory reports are of use:

"In reply to your favor of July 8, I will say that the greatest benefit derived from the examinations for diphtheria bacilli was in convincing certain physicians and school officials of the true nature of the epidemic, and thus making possible the establishment of quarantine and closing of schools. Had examinations been made in the first cases much trouble and expense would have been saved. Probably the next in value is the determination of the length of quarantine; one of my cases having bacilli for at least forty-five days. At this distance the benefits for early diagnosis are not so great as in nearer points, but the detection of mild cases of diphtheria and the positive proof that severe cases of pharyngitis and tonsillitis are not diphtheria, are invaluable. In fact, the laboratory is a boon to the country practitioner who has no time for such work, and to the people of limited means who have no money to pay for private laboratory work."

"In reply to your letter of the 6th instant, I would say that we have found the use of your laboratory valuable chiefly in differentiating diphtheria from tonsillitis. In the epidemic which we had last year in and about Cucamonga the majority of the cases presented the clinical characteristics of tonsillitis, and it was only by your laboratory work that we were able to diagnose and control the disease. In this epidemic none of the cases were fatal, but a few developed serious after effects. From time to time, however, we have had fatal cases of diphtheria in our community, and it is my belief that they have developed from these cases which pass clinically as tonsillitis, but which now, by using your laboratory for the bacteriological examination, we are able to properly class as diphtheria and by the continued and more extended use of the same many lives will undoubtedly be saved."

"Answering yours of the 6th instant in regard to value of work of the State Hygienic Laboratory, would say:

"1. Greatest value of examinations in my practice (made by you) has been to give the voice of authority to diagnoses, insuring more thorough coöperation on the part of

responsible persons. This would come under your heading (d), confirmation of positive clinical diagnosis.

"2. Work has not happened to prove of value to me in early diagnosis of diphtheria, as I have used diphtheria antitoxin in every case where I made a clinical diagnosis, without waiting for bacteriological diagnosis.

"This is in large part due to conditions arising out of our extremely poor mail facilities. Same is true of (b), detection of mild cases. In one case where there was an element of doubt as between scarlet fever and diphtheria, bacteriological examination decided, although the clinical diagnosis in that case was scarlet fever.

"In its saving to municipalities, in insuring more thorough quarantine regulations and thereby cutting down net losses, not only municipal, but also individual, the wisdom of the establishment of this laboratory has, in my judgment, been completely vindicated.

"An experience in a diphtheria epidemic in Golien, Mich., in 1897-9, covering upward of 87 cases, where we were deplorably handicapped by lack of just such facilities, enables me to appreciate the work of the laboratory as I might possibly not otherwise."

"I can not too highly commend the excellent work that the Hygienic Laboratory is doing—and for my part, it has rendered inestimable service to myself during the recent diphtheria epidemic that has visited this town. Unfortunately, during the early weeks of the disease we were unaware that such help existed, and it was only when the trouble reached such a climax that we were forced to seek aid from Dr. Foster that he told us of the laboratory, and from then on our labors were lightened and the mischief began to disappear. Before we knew of the laboratory the deaths from the disease by percentage were great, and since we began using your institute we have had no deaths from diphtheria at all. We were able to make an early diagnosis and institute appropriate measures; moreover, we were able to keep under supervision suspicious cases until we heard from you, and thus limit the spread of the disease. Personally, I have used your laboratory on every case of mine and it has been a great relief to me in many ways, and I can never thank you and your assistants sufficiently for the great aid you have been to me, and I am confident that, were your institute better known, it would be the means of saving the lives of many little ones."

[All diphtheria blanks are blue.]

DIRECTIONS FOR COLLECTING SPECIMENS FOR EXAMINATION FOR DIPHtheria BACILLI.

STATE HYGIENIC LABORATORY—UNIVERSITY OF CALIFORNIA, BERKELEY.

Directions for Taking Specimen.

Place patient in good light, and if a child, hold properly.

Depress the tongue so as to get a clear view of throat.

With swab rub the suspicious portions firmly, twisting it around while in contact with patch.

Remove swab from throat without touching other parts of mouth if possible. Without laying down the swab perform the succeeding manipulations.

Warm the mouth of the tube of culture medium to melt paraffin, which facilitates the removal of the cotton stopper.

Remove cotton stopper from culture tube and hold between fingers, gently rubbing the swab over the culture medium without injuring its surface.

Replace cotton in culture tube and replace swab in the other tube and plug with cotton stopper.

Place in case and send immediately to laboratory. In order to prevent breakage, wrap the two tubes carefully in the manner in which they were received.

An antiseptic used immediately prior to taking the specimen will interfere with the subsequent development of the culture.

Old dried culture medium is undesirable and may retard the growth of the organisms.

RECORD CARDS FOR EXAMINATIONS FOR DIPHtheria BACILLI.

STATE HYGIENIC LABORATORY—UNIVERSITY OF CALIFORNIA, BERKELEY.

Please fill out this blank in full and return to laboratory with culture.

Patient's name	Address
Physician's name	Address
Health Officer's name	Address
Has case been reported on before?	When?
Patient's age	Sex
Date of earliest symptoms	This is the 1st, 2d, 3d culture.
How contracted	Date of taking culture
Has antitoxin been used?	Is membrane present?
Has antiseptic been used within two hours in mouth or throat?	When?
Clinical diagnosis	Amount

Report by { telephone
 telegraph (collect)
 mail

DIPHTHERIA.

Examination No.
 Date received Hour
 Placed in incubator Examined
 Result:
 Type of bacillus on swab
 Type of bacillus in culture
 Associated bacilli
 Remarks
 Reported by { telephone } By Date
 { telegraph }
 { mail }

REPORT BLANK FOR EXAMINATIONS FOR DIPHTHERIA BACILLI.

STATE HYGIENIC LABORATORY—UNIVERSITY OF CALIFORNIA.

BERKELEY, ..., 190...

Dr.

DEAR SIR: In the examination of the culture from the case
 of taken
 diphtheria bacilli were found.

....., Director.

Circumstances Influencing Interpretation of Results Obtained.

No diphtheria bacilli may be found in culture for a variety of reasons, as (a) use of antiseptic wash or spray in throat before taking specimen; (b) failure to apply swab thoroughly to affected region of throat; (c) failure to smear infected portion of swab over blood serum; (d) or actual absence from throat. If old dried culture tubes are used, no development or scanty growth may occur. In case of positive findings it is desirable that another test be made after the complete disappearance of membrane, before case is released from quarantine.

TYPHOID FEVER.

The Widal test is made upon blood collected dry, upon an aluminum sheet, after the method described by Dr. F. F. Wesbrook, director of the laboratory of the Minnesota State Board of Health. Thirty-two Widal tests have been made.

[All typhoid fever blanks are white.]

DIRECTIONS FOR COLLECTING SPECIMENS FOR WIDAL TEST, AND RECORD CARDS FOR THE SAME.

STATE HYGIENIC LABORATORY—UNIVERSITY OF CALIFORNIA, BERKELEY.

Outfit for Collecting Specimen of Blood for Serum Diagnosis of Typhoid Fever.

Remember that a reaction does not often occur before the end of the first week of the disease. To insure a satisfactory test, observe carefully the following directions:

Securing Sample: Wash lobe of ear or finger tip thoroughly with boiled water. Pierce skin with clean needle, and with enclosed wire loop transfer four or five droplets of blood to different spots on edge of enclosed sheet of foil. ALLOW BLOOD TO AIR DRY AT ROOM TEMPERATURE (never heat it), then fold over foil to protect blood clot.

Sending Sample: Enclose folded aluminum sheet and wire loop in this envelope, together with data blank (properly filled out), and mail to laboratory.

Telegraphic reports will be sent when requested, charges collect.

STATE HYGIENIC LABORATORY—UNIVERSITY OF CALIFORNIA, BERKELEY.

Please fill out blank in full and send to laboratory with dried blood.

Patient's name Address
 Physician's name Address
 Health Officer's name Address
 Has this case been reported before? When?
 Patient's age Sex This is the 1st, 2d, 3d specimen.
 How long since disease commenced? Date of taking specimen
 Supposed source of infection
 Has patient been away during month previous to illness?
 When, if ever before, has patient had typhoid fever?
 Clinical diagnosis

Report by { telephone }
 { telegraph (collect) }
 { mail }

TYPHOID FEVER.

Examination No.
 Date received Hour
 Age of culture Strain
 Dilution Agglutination Time
 Remarks

Reported by { telephone }
 { telegraph } By Date
 { mail }

REPORT BLANKS FOR EXAMINATIONS FOR TYPHOID FEVER.

STATE HYGIENIC LABORATORY—UNIVERSITY OF CALIFORNIA.

BERKELEY, ..., 190...

Dr.

DEAR SIR: The specimen of blood of
 taken diluted
 the reaction characteristic of typhoid fever.

....., Director.

Circumstances Influencing Interpretation of Results Obtained.

The reaction characteristic of typhoid fever is not likely to occur earlier than the fifth day of the disease.

The reacting substance persists in the blood for a considerable time after recovery. One must therefore be sure that a previous attack has not happened within two years.

"A negative result obtained with the serum of a case of suspected typhoid affords a presumptive evidence against the diagnosis of typhoid fever, but this is only probability, especially if the examination has been made in the first few days of the disease. The examination should then be repeated within the next few days. The presumption that a case in which a negative result has been obtained is not typhoid, becomes stronger as the stage of the disease becomes more advanced." (Widal.)

In doubtful cases we will examine later samples of blood at intervals of about two days, until diagnosis is settled.

Please let us know if the course of the case shows anything different from what our findings would lead you to expect.

TUBERCULOSIS.

Fifty-four examinations of sputum for tubercle bacilli have been made.

[All tuberculosis blanks are yellow.]

DIRECTIONS FOR COLLECTING SPUTUM.

STATE HYGIENIC LABORATORY—UNIVERSITY OF CALIFORNIA, BERKELEY.

Directions for Collecting and Sending Sputum.

The expectoration discharged in the morning is preferred.

Have the patient wash out the mouth and throat with pure water early in the morning and then cough up the sputum from the lower air passages.

Care should be taken that the contents of the stomach, articles of food, etc., are not discharged during the act of expectoration and collected instead of the ordinary sputum. Purulent, cheesy, and muco-purulent sputum most frequently contain the bacilli; pure mucus, blood, or saliva do not, as a rule, contain the bacilli.

If the expectoration is scanty, the entire amount discharged in twenty-four hours should be collected.

The sputum should not be kept, but forwarded in as fresh a condition as possible.

RECORD CARDS FOR EXAMINATIONS FOR TUBERCLE BACILLI.

STATE HYGIENIC LABORATORY—UNIVERSITY OF CALIFORNIA, BERKELEY.

Please fill out this blank in full and send to laboratory with sputum.

Patient's name Address
 Physician's name Address
 Health Officer's name Address
 This is the 1st, 2d, 3d specimen discharged during Date
 Patient's age Sex Occupation
 Are there other cases in the same household? If so, how many?
 Clinical diagnosis

Report by { telephone }
 { telegraph (collect) }
 { mail }

TUBERCULOSIS.

Examination No.
 Date received Hour
 Result:
 Number of tubercle bacilli
 Associated bacilli
 Other contents of sputum
 Remarks
 Reported by { telephone } By Date
 { telegraph }
 { mail }

REPORT BLANKS FOR EXAMINATIONS FOR TUBERCLE BACILLI.

STATE HYGIENIC LABORATORY—UNIVERSITY OF CALIFORNIA.

BERKELEY, ..., 190..

Dr.

DEAR SIR: In the examination of the specimen of sputum
 from taken
 tubercle bacilli were found.

....., Director.

Circumstances Influencing Interpretation of Results Obtained.

If the result of the examination is negative, it is not to be assumed that the case is not one of pulmonary tuberculosis, for frequently, in this disease, tubercle bacilli are at times absent from the sputum and the disease can only be probably excluded if repeated examination of the sputum fails to show the presence of bacilli. If the first examination in a case is negative, other specimens should be sent for examination.

The demonstration of the presence of tubercle bacilli in the sputum proves conclusively the existence of tuberculosis, but the absence of tubercle bacilli, or the failure to find them microscopically, does not exclude the existence of the disease.

BUBONIC PLAGUE.

One culture from a suspected case of bubonic plague was submitted by a municipal laboratory, in order that another independent conclusion might be reached. A detailed study of the culture, and of the lesions produced by it in guinea pigs, led to its recognition as *B. pestis*.

WATER SUPPLIES.

Sixty-seven samples of water have been examined with reference to sewage pollution. The impression exists in many quarters that a bacteriological examination of the water supply during a typhoid epidemic will determine exactly whether or not the water is the source of infection. Much more conclusive evidence could be obtained by a careful study of a history of the cases with particular reference to the source of their drinking water, previous to attack. To insure the most satisfactory results, it is desirable that the judgment of the character of a water supply be drawn from facts derived by (a) sanitary survey of the source, (b) bacteriological examinations of samples preferably collected by an expert, (c) chemical analysis. In reporting on many samples of water it has been necessary to rely upon persons submitting the sample, for information about the sanitary condition of the source. For the chemical work, Prof. George E. Colby, of the College of Agriculture, has generously contributed his services.

To put this branch of the laboratory in a thoroughly satisfactory condition will require a large amount of bacteriological work to deter-

mine the kinds and numbers of bacteria present in the various sources of water supply at different seasons.

The demand for the study of water supplies and the importance of the subject warrants the addition of two experts to the staff of the laboratory to handle the water work.

[Water blanks are pink and red.]

DIRECTIONS FOR COLLECTING SAMPLES OF WATER.

STATE HYGIENIC LABORATORY—UNIVERSITY OF CALIFORNIA, BERKELEY.

Directions for Collecting Samples of Water.

The outfit for obtaining water samples consists of two parts. The gallon bottle is for the sample for chemical analysis. The small bottle, for the sample for bacteriological examination, has been sterilized before being sent from the laboratory and must not be opened until ready to collect. The two bottles must be filled at the same time and at the same place.

Sample for Bacteriological Examination.

When you are ready to take the sample, not before, take the small bottle from the can. Under no circumstances touch the stem of the stopper, nor allow the inside of the neck of the bottle to touch anything. Do not lay the stopper down, but hold it in the fingers by the head until sample is taken.

From a Stream, Pond, or Reservoir: Loosen, without removing, the stopper. Hold the bottle in one hand and the stopper in the other. Lower bottle about a foot below the surface, avoiding any scum or sediment. Then remove the stopper quickly to a distance of one foot. Turn the mouth of the bottle away from the hands and move it forward while it is filling. If there is a current, turn the mouth of the bottle against it. The bottle must be filled only to the base of the neck, leaving an air space. Replace the stopper and immediately fasten it in securely with the foil.

From a Tap: Allow the water to flow 10 minutes before filling the bottle. Do not rinse out the bottle.

From a Pump: Pump should be in continuous operation for at least 10 minutes, preferably half an hour, before sample is taken.

Place the small bottle in the smaller can and press the lid down. Then pack it in broken ice and excelsior in the larger can.

Sample for Chemical Examination.

Before collecting a sample, the bottle and stopper must be thoroughly rinsed twice with the water to be examined, and neither the inside of the neck of the bottle nor the stem of the stopper must be touched by the hand or wiped with a cloth during or after these operations.

After rinsing, fill the bottle to a point about 2 inches below the bottom of the stopper. Secure the stopper in the bottle by means of a clean cloth, or a clean heavy paper, double if necessary and tie about the neck of the bottle.

From a Tap, Spigot, or Hydrant: Allow the water to run for fully 10 minutes before collecting, then rinse and fill the bottle as directed above.

From a River, Pond, Reservoir, or Basin: Rinse the bottle as directed. Lower it, with the stopper in place, into the water to a depth of 12 inches below the surface, remove the stopper, allow the bottle to fill completely and replace the stopper before bringing to the surface to avoid collecting any scum. When brought to the surface, pour out a small quantity so that the sample shall fill the bottle to a point 2 inches below the bottom of the stopper. If the water is shallow, collect the running water in a clean vessel and pour into bottle. Precautions must always be taken not to stir up any sediment.

Shipping.

Fill out fully the card, in the envelope attached to the lid, according to the direction printed thereon, and then replace in same envelope. Place both bottles in their proper compartments in the shipping case, lock the box with the enclosed padlock and ship, by express, prepaid, to the State Hygienic Laboratory, University of California, Berkeley, Cal., as soon after collection as possible. Samples should not be sent so as to be en route over Sunday.

RECORD CARDS FOR WATER EXAMINATION.

To be filled out by person collecting sample.

Time of collection: Year?.....Month?.....Day?.....Hour?.....Min.?.....a.m. or p.m.?

(Give exact description of source, whether from tap, stream, reservoir, or pond, and if there are any unusual conditions these should be noted under the head of "Remarks.")

Sample from

Remarks

Collected by

REPORT OF THE STATE BOARD OF HEALTH.

STATE HYGIENIC LABORATORY—UNIVERSITY OF CALIFORNIA, BERKELEY.

Chemical Examination of Water.

(Parts per million.)

Serial No.	Received.			Temp.	Odor.	Appearance.		Residue on Evaporation.				
	Year, Day, Month.	Hour.	A. M. or P. M.			Turbidity.	Color.	Total Solids.	Suspended Matter.	Dissolved Mineral Matter.	Loss on Ignition.	

Nitrogen as					Oxygen Dissolved.	Chlorine.	Iron.	Acidity.	Alkalinity.	Incrustants.	Total Hardness.	Free Carbonic Acid.
Free Ammonia.	Organic Nitrogen.	Albuminoid Ammonia.	Nitrites.	Nitrates.								

STATE HYGIENIC LABORATORY—UNIVERSITY OF CALIFORNIA, BERKELEY.

Bacteriological Examination of Water.

Examination No. Age of sample. Date

Agar plates: Inoculated with Incubated for hrs. at
 Colonies per c.c. Average

Gelatin plates: Inoculated with Incubated for hrs. at
 Colonies per c.c. Average

Glucose bouillon: Incubated at for

Amount Used.	100 c.c.	10 cc.	1 c.c.	0.1 c.c.	0.01 c.c.
Gas					
H CO ₂					

Remarks

Presumptive tests for *B. coli*:

Character of Colony on Litmus Lactose Agar.	Ordinary Agar.	Gelatin.	Fermentation Tube.			Indol	Milk coagulation.	Reduction of Nitrates.
			Turbidity.	% Gas.					H. CO_{2}
				24 hrs.	48 hrs.			

 Reported by { telephone }
 { telegraph } by Date
 { mail }

MISCELLANEOUS PATHOLOGICAL WORK.

Ninety-six determinations of various kinds have been made. These comprise examinations of material from cases of anthrax, glanders, gonorrhea, and examinations of blood, milk, and urine. The urine and blood work was done for the physicians in charge of the hospital for San Francisco refugees, established on the University campus.

[Miscellaneous blanks are salmon.]

RECORD CARDS FOR MISCELLANEOUS EXAMINATIONS.

STATE HYGIENIC LABORATORY—UNIVERSITY OF CALIFORNIA, BERKELEY.

Miscellaneous Examinations.

Material.....	Animal.....
Received from.....	Address.....
Description of material.....	
Clinical diagnosis.....	
Cultures.....	
Examination No.....	
Injected into.....	
Result.....	
Microscopical examination—	
Direct.....	
Hardened in.....	Embedded in.....
Sectioned.....	Stained.....
Result.....	
Chemical examination.....	
Reported by { telephone } { telegraph } { mail }	By..... Date.....

ASSISTANCE TO THE SAN FRANCISCO HEALTH COMMISSION.

Owing to the crippled condition of the bacteriological laboratory of the San Francisco Health Commission, a considerable amount of culture media has been supplied to them. At the request of Dr. D. F. Ragan, the Health Officer of San Francisco, an examination was made of some bottled "soft drinks" made in Oakland, and sold in large quantity in San Francisco shortly after the fire. A quotation from the report made to Dr. Ragan is herewith presented: "The important fact revealed by the bacteriological examination of these beverages is that the water of which they were made was not boiled. The last three, judged as drinking water, from a bacteriological standpoint, would be reported 'probably unsafe.'"

MUNICIPAL MILK SUPPLY.

During the summer of 1905, Dr. George F. Reinhardt, Health Officer of Berkeley, enforced the dairy ordinance requiring that cows supplying the town be tested with tuberculin. The opposition of the dairymen resulted in the disclosure of legal flaws in the ordinance, which prevented the completion of the work. The writer supervised the testing of the cows and herewith presents some extracts from a report on the work, made to the town health officer:

STATISTICAL SUMMARY.

<i>All Dairies—</i>	
Number of cows tested.....	383
Number of cows approved.....	319
Number of cows condemned.....	64
Retest, not included in other figures.....	4
Per cent condemned.....	16.7
<i>Large Dairies—</i>	
Number of cows in dairy over five.....	329
Number of cows approved.....	267
Number of cows condemned.....	62
Per cent condemned.....	18.8
<i>Small Dairies—</i>	
Number of cows in dairies of five and less.....	54
Number of cows approved.....	52
Number of cows condemned.....	2
Per cent condemned.....	3.6

Of the sixty-four animals condemned, I regarded nine as showing physical signs of tuberculosis and would have condemned them without the additional evidence furnished by their reacting to the test. The others would not have been recognized as tubercular unless the test had been used. It does not follow that a cow reacting to the tuberculin test, but not showing physical signs of tuberculosis, is not a source of danger to public health and to other animals. On the contrary, it is a well-recognized fact that cows may frequently appear in the best of condition and yet be extensively affected with tuberculosis. Dairymen keep weeding out those cases which are visibly diseased, in their judgment, but the practice does not materially improve conditions with respect to the existence of tuberculosis in the herds. Any inspection for tuberculosis, other than by the use of the tuberculin test, will fail to accomplish the desired purpose.

The fact that 18.8 per cent of all cows tested in large dairies about Berkeley were tubercular, and that of the cows isolated from others of their kind only 3.6 per cent reacted, illustrate well the contagious nature of tuberculosis.

The experience of others, and my own in similar work elsewhere, leads me to conclude that the above figures regarding the percentage of tuberculosis in large dairies do not give an exaggerated idea of the conditions existing in other large dairies. Once it has been my disagreeable duty to condemn thirty-five per cent of a herd of one hundred and twenty cows. In such large dairies where the tuberculin test has not been used to improve conditions, the percentage of tuberculosis will be found much higher than the general average found so far in Berkeley dairies.

CHEMICAL WORK.

No chemical work such as herein reported would have been possible but for the generous assistance of chemists of the Agricultural Department of the University. Professor Colby's assistance has been mentioned in connection with the discussion of water examination.

The examination of food products with reference to their nutritive value and with reference to the presence of preservatives, or adulterants, is a branch of public health laboratory work, the importance of which is obtaining wide recognition. To enable the laboratory to meet the demand for this class of work, Prof. M. E. Jaffa has kindly volunteered his services, and herewith submits a report on the chemical work done for the State Hygienic Laboratory:

It has been the ardent wish of the Food Laboratory of the University of California to have exercised in this State a modern Food Inspection law, similar to the Fertilizer Control law. Therefore, with a view of creating a greater demand for, and exciting public interest in, this line of work, the personnel of the Food Laboratory has done all that it could, with its limited facilities, to assist the State Hygienic Laboratory.

Chemical analyses have been made of foods and other materials received from different parts of the State. The nature of the examinations has been very varied, as will be seen by a review of the data here presented. A small portion of the work accomplished has appeared from time to time in the bulletins of the State Board of Health, but by far the major part has been of purely local interest, so has not been made public. Among the important analyses made at laboratory, the following may be cited:

Evaporated Creams.—In response to many inquiries concerning the nutritive value of so-called evaporated creams, a systematic investigation was undertaken of all samples of those foods to be found in the local market.

Analyses of so-called Evaporated Creams.

Lab No.	Brand.	Manufacturer.	Water.	Casein, etc.	Fat.	Lactose.	Mineral Matter.
512	Carnation brand sterilized cream	Pac. Coast Cond. Milk Co.	76.78	6.06	7.50	8.11	1.56
519	California Poppy brand evaporated cream	Cold Brook Creameries	78.90	6.23	5.90	7.80	1.17
520	Isleton evaporated cream	Western Creameries Co.	77.99	5.88	6.90	8.00	1.23
546	Lilly cream	Pacific Creamery Co.	78.21	6.12	5.40	8.91	1.36
547	Jersey evaporated sterilized cream	Cond'sed Milk Co. of Cal.	80.22	5.55	4.80	8.18	1.25
548	Highland brand evaporated cream	Helvetia Milk Cond'g Co.	72.48	7.56	7.50	10.86	1.60
549	Yacht brand evaporated cream	Borden Cond. Milk Co.	75.28	7.15	8.10	7.84	1.63
586	Pet brand evaporated cream	Helvetia Milk Cond'g Co.	70.47	7.57	9.90	10.42	1.64
587	Red Ribbon evaporated cream	Elmira Cond. Milk Co.	78.81	5.87	5.70	8.33	1.29
588	Silver Cow evaporated cream	St. Charles Milk Cond. Co.	70.73	7.42	9.30	10.93	1.62
593	Alpine cream	Alpine Evap. Cream Co.	75.13	6.72	7.20	9.46	1.49
594	Pioneer brand evaporated cream	Borden Cond. Milk Co.	70.45	7.27	10.20	10.55	1.53

No determinations were made on the above samples for either adulterants or preservatives. The investigation was undertaken with a view of showing the necessity of a food inspection law which would enable consumers to buy food materials honestly labeled.

These tabulated results show that the "evaporated creams" do not approach in fat content that of an average cream, which should contain at least twenty per cent fat. The food value of these products is about double that of ordinary milk, and consequently they should be labeled "condensed milk."

On the Occurrence of Hydrocyanic Acid in Johnson-Grass.—Word was received at the University of California that cattle were dying at Los Banos. Owing to the nature of the symptoms it was decided to make a chemical analysis of Johnson-grass (*Sorghum halepense*), which appeared to be the cause of the deaths. The result of the chemical analyses showed conclusively that the grass contained hydrocyanic acid in appreciable quantities. A request was then made to the owner of the cattle for another specimen of the Johnson-grass, and also of one of a rank-growing grass at the same stage of growth as the Johnson-grass, but which did not kill the cattle. Upon receipt of the specimens at the laboratory, chemical examinations were made, with the result that hydrocyanic acid was found in the fresh Johnson-grass to the extent of five-hundredths of one per cent; and to be entirely absent from the other specimen—barnyard-grass (*Panicum crus-galli*). This is the first time in California (to our knowledge) that hydrocyanic acid has been found in Johnson-grass. In Bulletin No. 77, issued in January, 1903, by the Agricultural Experiment Station of the University of Nebraska, are given the results of a similar investigation made there with reference to common sorghum and kafir corn, both of which are relatives of the Johnson-grass. The following paragraph, referring to antidotes, is taken from the bulletin in question:

"Prussic acid has a tendency to unite with certain carbohydrates, forming additional products. These compounds are much less poisonous than the free acid. Both glucose and milk sugar unite with prussic acid to some extent even in dilute solutions. Aside from this action these carbohydrates retard the action of enzyme in liberating prussic acid. These facts suggest that, in case the animal is not in such a condition as to render medical treatment out of the question, the following may be effective: A strong solution of glucose, which nearly every farmer has on hand in the form of 'corn syrup,' or molasses, may be administered. Large quantities of milk have in a number of instances been administered, apparently with good effect. In all cases the animal should have as much fresh air as possible."

Lye-peeled Peaches.—Much discussion has arisen concerning the safety of the process of treating peaches with lye so as to admit of rapid and economical peeling of the fruit to be canned. The fruit is immersed in hot lye for a very short period and is then washed several times with cold water, thus removing the alkali. In order to test the alkalinity of the juice of canned peaches put up by the lye process, and compare it with that of the fruit as usually canned, two analyses were made—one of lye-processed peaches and the other of a can of hand-peeled fruit. The result of the analyses showed that neither can showed alkaline juice. The acidity of can No. 38 was 0.32 per cent calculated in terms of sulphuric acid, while that of can No. 4 was 0.39 per cent. These figures are only very slightly below, if at all below, the acidity of a ripe peach. We have data for the acidity of some ripe peaches which show 0.5 per cent, which is very little higher than that shown in No. 4. There is nothing harmful in any way in these peaches.

Chemical Investigation for Board of Health of Santa Clara County.—These analyses were made in accordance with requests of Dr. Simpson to the State Hygienic Laboratory, and included a considerable number of samples of canned fruit and vegetables. It

is a source of satisfaction to know that none of the samples tested were found to contain any preservative, or subject deleterious to health.

Work Done for Board of Health, Point Richmond, Cal.—During the last three months this laboratory has examined twenty-five samples of milk for Dr. Barney, Health Officer, Point Richmond, with reference to the chemical composition and adulterants. Two of the samples submitted showed the presence of formalin in appreciable quantities. The use of this antiseptic, however, has been discontinued, through the energetic efforts of Dr. Barney.

Milks.—A large number of analyses of samples of milk and cream have been made in response to inquiries sent in from Alameda and other parts of the State. In every case preservatives have been tested for in addition to the usual analysis made for the purpose of ascertaining the quality of the milk.

Examination of Miscellaneous Samples of Foods and Food Products, Preservatives, etc.—These have included the analyses of specimens of grape juice (1), raspberry wafers (2), flours (6), butters (3), condensed milks (5), creams (10), hay (2), formalin (5).

Toxicological Work.—In addition to the work done on foods and food products, no inconsiderable time was spent on examinations of materials for the occurrence of poisons. Prominent among such was the testing of organs from animals suspected of having died of poisoning. In response to the request of the Napa State Hospital, examinations were made of contents of stomachs of some cows which had died under suspicious circumstances. Tests were made for common poison in the contents of the stomach and also of some of the organs, as the liver, etc. Negative results were obtained in every case. The contents of stomachs showed high alkalinity which suggested poison by lye; a further examination showed the presence of an excess of potash. This fact, in connection with the symptoms, conclusively showed that the animals had died of lye poisoning.

M. E. JAFFA.

INVESTIGATIONS OF THE SAN FRANCISCO MILK SUPPLY.

On October 3, 1905, the Board of Supervisors of the City and County of San Francisco passed the following resolutions, afterwards approved by the Mayor:

Resolved, That Professor A. R. Ward, Director of the State Hygienic Laboratory, at the University of California, and Professor M. E. Jaffa, also of the University of California, be and they are hereby requested to inspect the dairies and investigate the milk industry of the city;

Further resolved, That the sum of \$925 be and it is hereby set aside out of the fund for urgent necessities to cover the expense of bacteriological examinations of milk.

Later, to provide for a continuance of the work, a similar resolution was passed, as follows:

Resolved, That the sum of seven hundred dollars (\$700) be and is hereby set aside out of the appropriation for urgent necessities to complete the investigation of the dairies and milk supply of this city under the direction of the State Hygienic Laboratory of the University of California.

A staff of assistants to carry on the necessary field and laboratory work was organized with all possible expedition. Work was carried on for about three months, during which time it was possible to make a thorough survey of the condition of the San Francisco milk supply. Besides the inspections of dairies and cows, a large amount of microscopical work was done in the examination of milk for leucocytes.

Herewith are presented copies of the two reports made to the San Francisco officers regarding the character of the milk supply. A paper on "The Numerical Determination of Leucocytes in Milk," based on data obtained in the San Francisco milk investigations, forms a part of the present report.

DR. A. A. D'ANCONA, *San Francisco, California.*

DEAR DOCTOR: We herewith present a preliminary report of the special investigation of the San Francisco milk supply conducted by us during the past four weeks.

In view of the public alarm over the use of chemical preservatives in milk we have endeavored to examine for such substances as many samples as possible. These represent the product as it reaches the city, and as it is sold to the consumer from wagons bakeries, and groceries.

Five hundred and forty-nine (549) samples of milk and cream have been analyzed for boracic acid compounds, formaldehyd, carbonates, and coloring matter. Boracic acid was found in five (5) samples—four cream, three of which were labeled "Borated Cream," and in one sample of milk. (See Appendix A.) None of the other substances mentioned above were found in any case. Tests were made for fluorids in all samples not soured within twenty-four hours after arrival at the laboratory, but the result was negative in every case.

In four hundred and forty-six (446) samples, representing the milk as it reaches the consumer, the specific gravity was determined and quantitative determinations were made for fat and ash. In thirty-eight (38) samples the fat was below the three per cent (3%). Details concerning these appear in Appendix B. In sixty-seven (67) samples the fat per cent ranged from 3 to 3.3 per cent, inclusive. (See Appendix C.) A map showing areas covered by city collector is appended.

Of the total number mentioned, one hundred and three (103) analyses were made of samples representing the milk as it reaches the city via train, boats, and wagon. In each case quantitative determinations were made for all of the milk constituents, in addition to the tests for preservatives above noted. These samples represent practically all of the large producers supplying the city. Of these, only three (3) showed a fat content under 3.4 per cent and none under 3 per cent. (See Appendix C.) No preservatives were found in any samples.

It should be stated that the casein and ash percentages were lower in many cases than the average generally accepted. This does not mean that the milk in question had been sophisticated, for the fat and sugar contents were normal, but merely indicates a condition not usually supposed to exist. Consequently a duplication of samples is desirable in these cases.

The exceptionally good showing of the samples examined for preservatives can hardly be taken as indicating the condition of the milk at other seasons of the year. The recent great popular protest, the hue and cry of the press, and the activity of the City Board of Health, have doubtless been the means of checking the use of preservatives in the milk. It should be noted that the present season furnishes the most favorable conditions for the keeping of milk without the use of chemical preservatives.

The number of leucocytes in milk, and the significance thereof, is receiving the serious attention of progressive health departments at present. Methods for the determination of leucocytes are being gradually perfected, and the number of leucocytes to be regarded as abnormal is still a subject of investigation.

We have made two hundred and twenty-seven (227) microscopic examinations for leucocytes, and find that in but one case have they exceeded the tentative standards set by health departments of Philadelphia and Boston. We believe, however, that before drawing conclusions it would be highly desirable that these laboratory investigations should be accompanied by a careful examination of the udders of the cows; but the opportunity to do this has been limited.

An important phase of an investigation of the kind in which we are engaged is the sanitary inspection of all dairies supplying milk to the city, and of milk depots in the city. Our inspectors are provided with printed blanks, in which are enumerated, in condensed form, the points covered by the San Francisco dairy ordinances. They are also provided with a score card adopted by the State Dairy Bureau. By the intelligent use of these blanks it is possible to collect accurate data regarding the sanitary condition of the dairies and the condition of the udders of the cows as regards disease. Specimens of the blanks mentioned are submitted in Appendix D. About twenty-five (25) dairies outside of the city have been inspected, the score averaging seventy-seven (77) out of a possible one hundred (100) points. About twenty-five (25) milk depots have been inspected.

Statistical Summary.

Total number of samples examined chemically.....	549
Samples subjected to complete chemical analysis.....	103
Samples from vendors, examined for specific gravity, fat, ash, and preservatives.....	446
Samples from vendors, illegally containing boracic acid compounds..	2
Samples from vendors (cream), labeled "Borated".....	3
Samples from vendors containing other preservatives or coloring matter.....	none
Samples from vendors containing less than 3% fat.....	38
Samples from vendors containing between 3% and 3.3% fat, inclusive..	64
Samples representing milk as it arrives in the city.....	103
Of these, containing less than 3% fat.....	none
Of these, containing less than 3.4% fat.....	4
Of these, containing preservatives or coloring matter.....	none
Total number of examinations for leucocytes.....	227
By the Doane-Buckley method.....	126
By the Philadelphia Bureau of Health method.....	101
Total number of numerical determinations of bacteria.....	35
Number of samples exceeding 500,000 per c.c.....	1
Number of samples below 500,000 per c.c.....	34
County dairies inspected.....	25
City milk depots inspected.....	25

Plans for Completion of Investigation.—About seventy-five dairies in the country have not yet been inspected and about the same number of milk depots in the city should be visited. This is obviously important in connection with an undertaking of this kind, and especially so as we are devoting attention to the condition of the cows' udders. This latter phase referred to is essential in throwing light upon the significance of leucocytes in milk. As yet, comparatively few numerical determinations have been made of the bacteria in milk.

The study of the subject of pathogenic bacteria in milk would be incomplete without examinations for tubercle bacilli. This requires that the samples be centrifuged and that guinea pigs be inoculated with the sediment thus obtained.

Many of the samples have shown a low casein and ash content, far below the accepted normal, while other constituents remained normal. In view of this, it seems highly desirable that further quantitative determinations be made on samples from dairies that have previously shown this abnormality. This point is of importance in connection with the careful modification of milk for infant feeding.

In conclusion we will say, in our opinion, the progress of the work, as outlined by the resolutions of your Board, is approximately half completed.

Respectfully submitted.

(Signed) M. E. JAFFA.
A. R. WARD.

APPENDIX A.

Samples found Adulterated with Boracic Acid Compounds and not so marked.

Lab. No.		Taken at	Nature of Sample.	Date.	Boracic Acid per cent.
180	L. Hauser.....	2216 Fillmore Street ..	Unbranded bo-rated cream....	Nov. 20	-----
528	H. Mesenburg....	370 Hayes Street.....	Unbranded bo-rated milk.....	Dec. 8	-----

APPENDIX B.

Summary of Determinations of Fat Ranging Below Three Per Cent.

Lab. No.		Taken at	Date.	Fat, per cent.
11	Prost's Bakery.....	226 Third Street	1905 Nov. 14	2.3

(In the original report this consisted of a record of thirty-eight samples, arranged like the above, but here omitted.)

APPENDIX C.

Summary of Determinations of Fat Ranging from 3.0 to 3.3 Per Cent inclusive.

Lab. No.		Taken at	Class of Business.	Date.	Fat, per cent.
3	J. E. Wagner.....	347 Fourth Street		1905 Nov. 14	3.2

(In the original report this consisted of a record of sixty-five samples, arranged like the above, but here omitted.)

APPENDIX D.

(Blanks used in dairy inspections.)

Blank for report on Inspection of Dairies with respect to the San Francisco Dairy Ordinances.

Owner.....	Location.....	A. M.....	P. M.....
No. cows.....	No. dirty.....	% No. diseased.....	%
Diseases.....			
Stable floor wood, cement, leaky, gutter, drain.....			
Stable walls whitewashed. Lighting sufficient. Bucket rest.....			
Privy or manure inside. Beds. Feed. Troughs clean.....			
Manure accumulates outside. Cows access to. Cows' drinking water.....			
No. milkers..... Clean..... Wash..... Healthy..... Fore milk.....			
Milk room isolated. Floor tight, washed daily, cement, wood, drain.....			
Walls tight, screened. Wooden vats, painted, clean.....			
Milk cooled by..... to.....° F. Leaks. Strainer.....			
Utensils, rust, cracks, clean. Pegs. Stored well.....			
Washing compound, soap. Renew. Rinsed in flowing water.....			
Scalded in closed vats..... Steam.....			
Wooden vats metal lined..... Water polluted or pure.....			

State Dairy Bureau Score Card.

Owner Address

	Perfect.	Rating.		Perfect.	Rating.
Healthy appearance of cows	5	-----	Pig and calf quarters	1	-----
Cleanliness of cows	10	-----	Stale milk and refuse	2	-----
Water, source and purity	7	-----	Utensils, construction of	2	-----
Cow yard—room, condition, etc.	10	-----	Cleaning and sterilizing	5	-----
Stable, ventilators, floor, etc.	10	-----	Separator clean	2	-----
Manure, disposal of	5	-----	Churn clean	1	-----
No decayed food in mangers	5	-----	Attendant's clothing	2	-----
Cobwebs	3	-----	Attendant's hands	2	-----
Stable, whitewashed	5	-----	Udders cleaned	1	-----
Dairy room, clean	5	-----	Milk at once removed to dairy	3	-----
Dairy room, distance of drainage	2	-----	Fore milk	1	-----
Dairy room floor	3	-----	Aerated and cooled, 68° F	2	-----
Cleaning facilities	2	-----	Sediment in milk	2	-----
			Butter, packing and weight	2	-----
Total				100	-----

FEBRUARY 1, 1906.

To the Committee on Hospital and Health of the Honorable Board of Supervisors of the City and County of San Francisco.

GENTLEMEN: As a portion of our report of work to date, we submit a copy of the preliminary report of December 11, 1905, to Dr. A. A. D'Ancona, chairman of the committee at that time.

The greater portion of the work done since December 11 concerns the sanitary condition of the dairies in and about San Francisco.

The inspections have included practically all of the dairies shipping milk to the city on the California Northwestern and North Shore Railroads and those within the City and County of San Francisco. Eighty-six (86) dairies have been inspected with reference to the details of building construction, health of cows, and manner of milk handling mentioned in the dairy ordinances of the City and County of San Francisco.

Attention should be called to the fact that only those dairies situated within the city and county can be forced to comply with certain features of the city dairy ordinances. Nevertheless, we have reported all on the basis of their having complied with or violated the ordinances in question.

In the following list we present an analytical summary of the results of the inspections. There is given the percentage of compliance with and of violation of the various features of the ordinance:

Number of dairies inspected	86
Number of cows inspected	9,199
Dairies in which were found cows with inflamed udders	31%
Dairies in which other diseases were observed	24%
Dairies entirely healthy in appearance	43%
Dairies showing dirty cows	33%

Stable.

Stable floor cement	2%
Stable floor wood	96%
Stable floor cement and wood	2%
Stable floor leaky	36%
Gutter present	87%
Drain present	28%
Walls whitewashed	89%
Lighting sufficient	67%
Bucket rest three feet from floor, present	66%
Privy inside stable	3%
Manure accumulates inside stable	11%
Manure allowed to remain in heaps outside for over seven (7) days	72%
Cows have access to above	51%
Sleeping quarters under cow stable roof	21%
Feed apparently wholesome	98%
Feeding troughs clean	97%
Cows' drinking water apparently wholesome	96%

<i>Milkers.</i>		
Number		355
Clean in appearance	Compliance,	96%
Wash hands before milking	Compliance,	65%
Apparently healthy		100%
<i>Milk Room.</i>		
Isolated from stable	Compliance,	86%
Floor tight	Compliance,	93%
Washed daily	Compliance,	95%
Drain present	Compliance,	64%
Floor constructed of cement		55%
Floor constructed of wood		36%
Floor constructed of cement and wood		5%
Floor constructed of neither		2%
Side walls tight	Compliance,	90%
Windows screened	Compliance,	54%
Vats painted	Compliance,	23%
Vats clean	Compliance,	50%
Milk cooled by aërotor		89%
Milk cooled by standing tanks in water		2%
Milk cooled naturally		6%
Milk not reported		1%
Leaks present in milk cooler	Violation,	30%
<i>Utensils.</i>		
Strainers used		100%
Rust present in utensils	Violation,	23%
Cracks present in utensils	Violation,	9%
Clean utensils	Compliance,	97%
Utensils hung on pegs	Violation,	15%
Utensils stored in suitable place after washing	Compliance,	95%
Soap or washing compound used	Compliance,	100%
Utensils scalded	Compliance,	100%
Wooden vats, metal lined	Compliance,	15%
Water used for washing, apparently pure source		91%

Thirty-three (33) of the more important city milk depots have been inspected, and the results appear as follows:

Analytical Summary of Results of Inspection of City Milk Depots.

Milk room isolated	72%
Floor tight	Compliance, 97%
Floor washed daily	Compliance, 90%
Floor cement	51%
Floor wood	30%
Floor cement and wood	18%
Walls tight	Compliance, 90%
Windows screened	Compliance, 97%
Vats wood	69%
Vats painted	Compliance, 54%
Vats clean	Compliance, 72%
Milk cooled by shipper only	45%
Milk cooled at city depot with ice	27%
Milk cooled at city depot with aërotor	6%
Milk cooled at city depot by standing tanks in water	3%
Milk cooled at city depot naturally	3%
Milk cooled unreported	15%
Leaky aërotors	Violation, 30%
Strainers used	75%
Utensils rusty	Violation, 21%
Utensils containing cracks	Violation, 21%
Utensils hung on pegs	Violation, 6%
Utensils stored in suitable places after washing	Compliance, 94%
Washing compound or soap used	Compliance, 100%
Utensils scalded	Compliance, 100%
Wooden vats, metal lined	Compliance, 51%

The rating of the dairies by the use of the score card of the State Dairy Bureau makes it possible to present in small compass a statement of the relative condition of the dairies. The score card assigns a definite score for perfection in each of the important points in the construction of buildings and management of the dairy. The inspector, during his work, assigns to each feature on the card a number indicating in his judgment of the nearness to which each feature approaches perfection. With this system the perfect dairy would score 100 points. Table III gives a statement of the relative condition of the eighty-two dairies, based on the score. (This table in the original report contained a list of names of owners, location and score, arranged in order of excellence. To economize space, the list is omitted here.)

To give a better idea of the average conditions found, we may arrange the dairies in groups scoring within 10 per cent of one another, as follows:

<i>Sanitary Rating.</i> Perfection, 100%.	
Dairies scoring from 90 to 100%.....	12
Dairies scoring from 80 to 90%.....	28
Dairies scoring from 70 to 80%.....	37
Dairies scoring from 60 to 70%.....	13
Dairies scoring from 50 to 60%.....	none
Dairies scoring from 40 to 50%.....	2
82 dairies	

A glance at the tabulations of the results of inspection, and analytical summaries of the same, will show that the majority of the dairies were in a fair condition on the dates when inspected.

Certain facts brought out indicate the beneficial effects of the inspection by the Board of Health. The exceptions, however, indicate the necessity for a most rigid system of continuous inspection.

The difficulties in the way of securing a uniformly good municipal milk supply are many. The dairy business is one in which competition is most keen. The requirements of the production of sanitary milk are costly. The general public does not appreciate the cost of good milk and objects to paying what it is worth. Consequently close inspection is required to counteract the evil effects of competition in lowering the quality of the milk supply. Milk occupies a unique place among foods as a carrier of disease, and this fact should justify extensive expenditures for the proper supervision of the conditions under which it is produced.

We have paid particular attention to the number of leucocytes in milk and to the significance of their presence. During the progress of the work numerical determinations of the leucocytes have been made with the milk of each dairy inspected. In many cases two different methods of counting have been used and their accuracy compared. The work has resulted in the accumulation of a vast amount of data, but the time required to arrange the facts in an orderly condition prohibits our undertaking the task at present.

It has been assumed by some workers that the milk of the healthy cow contains few leucocytes and that a large number of leucocytes in milk indicates that milk from an inflamed udder is mixed in the milk. We have found milk of healthy cows to contain high numbers of leucocytes and consequently have been unable to set a standard for the determination of udder disease by counting of leucocytes.

No sanitary inspection of a public milk supply is complete and wholly satisfactory without the application of the tuberculin test to the cattle for the purpose of determining those affected with tuberculosis. The disease can be recognized in but few instances unless the tuberculin test is used. It is a matter of regret, therefore, that we can not present data relating to the extent of this disease among the cattle. The task of collecting such information is so enormous that it could not be included within the scope of this investigation. The tabulations contain reference to the disease, but it should be remembered that such observations are incomplete, and unsupported by the tuberculin test.

The extent of tuberculosis among dairy cattle is a matter of great sanitary importance, for there is very good reason to believe that the disease is transmitted from cattle to man through milk.

Enough is known of the prevalence of tuberculosis among dairy cattle in the San Francisco Bay region to warrant the statement that the disease constitutes the greatest obstacle in the production of sanitary milk for San Francisco.

We mentioned, in the first report, the desirability of collecting information on the matter of the spread of tuberculosis through milk, by inoculating guinea pigs. The progress of the work is delayed on account of difficulty in obtaining guinea pigs, but in a later report we shall present data on the subject.

One hundred and thirty-six (136) samples of milk and cream have been chemically examined since the date of our last report. One hundred and ten (110) of the samples of milk taken at dairies were subjected to complete chemical analysis; that is, the specific gravity, water, fat, casein, and mineral matter were determined in each of the cases. Nineteen (19) samples of cream, also taken at dairies, were tested for the fat content. Six (6) dairy samples of milk tested below 3.2 per cent of fat. The range of fat in the remaining one hundred and four (104) samples was as follows:

Between 3.2% and 3.8% fat.....	16 samples
Between 3.8% and 4.0% fat.....	19 samples
4% and above.....	69 samples

The casein and ash percentages were normal in nearly all of the dairy samples examined.

In the near future we hope to present comprehensive tabulations of the results of the microscopic examinations and of the results of the studies of the composition of milk.

Respectfully submitted.

(Signed) M. E. JAFFA.
A. R. WARD.

DISINFECTION WITH FORMALDEHYD.

Miss Margaret Henderson, assistant in the State Hygienic Laboratory, in addition to routine work, has carried out a series of experiments with formaldehyd disinfection. The details of the work are embodied in a paper by her, forming a part of the present report.

This work will be continued with some brands of solidified formaldehyd on the market in California.

FORMALDEHYD DISINFECTION.

By MARGARET HENDERSON, B.S.,

Assistant in the State Hygienic Laboratory.

These experiments with formaldehyd as a disinfecting agent were undertaken with the purpose of determining a safe routine method of disinfection that repeated experiment should prove efficient under the conditions that prevail in California, and that could be confidently recommended to health officers throughout the State.

The method simplest, easiest, and best adapted to conditions seemed to be that recommended by the State Board of Health of Maine, described by Evans and Russell.¹ The formaldehyd is liberated by the heat resulting from the chemical action between potassium permanganate and formalin, and no apparatus is required but a large vessel in which to mix the reagents. The simplicity of the method, the inexpensive apparatus, and the absence of danger from fire, make it an almost ideal method; and the only thing that remained was to prove that it was efficient under the conditions in California.

The experiments were conducted first in a room prepared for the purpose in the laboratory. The house was of the lightest possible construction, shingled outside, and finished inside with rough and loosely fitting boards, and so, to make it approach the tightness found in an ordinary dwelling house, the walls and ceilings were covered with paraffin roofing paper. Paper was pasted over the cracks around the three windows and one of the doors, and the second door was packed with felt strips. Nevertheless, there was some leakage, and a strong smell of formaldehyd was always perceptible in the other rooms of the house.

These tests under laboratory conditions were followed by tests in a room of an ordinary dwelling house, to make sure that the results were not merely laboratory results.

The test objects were prepared after a method suggested by M. J. Rosenau² in his paper on formalin disinfection of baggage without apparatus. Squares of filter paper, an eighth of an inch in width, were put into a sterile Petri dish, four in each dish, and sterilized. Each paper was then wet with a drop of a forty-eight-hour bouillon culture of the organism and allowed to dry. These Petri dishes were carried to the disinfecting room, and when everything was in readiness the tops were lifted off and set at one side of the dish. At the end of the exposure the tops were replaced and the dishes were carried back to the laboratory and the bits of paper dropped each into a tube of broth. The broth was incubated for forty-eight hours or more. At the end of that

¹ Evans and Russell. Formaldehyd disinfection. Thirteenth Annual Report State Board of Health of Maine.

² Rosenau, M. J. Formalin disinfection of baggage without apparatus. Bull. No. 2, Hyg. Lab. U. S. Public Health and Marine-Hospital Service, Washington, D. C.

time the tubes that did not show growth were reinoculated with the same organism and again incubated for forty-eight hours, to prove that the lack of growth was the result of the disinfection and not a fault of the medium or of the organism. Those tubes that showed growth were examined to make sure that the growth was not contamination, but really the organism that was inoculated into them on the paper. Controls were always arranged for each organism. A set of papers in Petri dishes, four to each organism, was inoculated at the same time as those to be disinfected, and allowed to stand on a bench in the well-lighted laboratory during all the time that the exposure was going on. After all the other papers had been put into bouillon these control papers were planted, and the after treatment of all the tubes was the same. In this way the chance that drying, or sunlight, or poor bouillon had led to the death of the organisms was ruled out.

The process was always started, the room was closed and allowed to remain closed for three hours and then opened and aired. When it was desired to make exposures for less than that time, the Petri dishes were put into a shallow drawer, either end of which would make a tight joint with the wall, and which could be opened either into the disinfecting room or into the room next to it. Petri dishes could be put into this drawer in the room next to the disinfecting room and then the drawer could be slid into the disinfecting room, and its end would completely close the hole in the wall. At the end of the desired time the drawer could be pulled out again and its other end would close the hole, and the Petri dishes could be removed, the whole process leading to very little loss of gas.

The Maine State Board of Health (Bulletin No. 75) recommends the use of a quart of formalin and thirteen ounces of potassium permanganate to a thousand cubic feet, with an exposure of three hours. The first series of experiments was done with this amount of formalin and with times varying from one hour to three hours. The organisms used were *Bact. anthracis*, *B. subtilis*, *M. pyogenes aureus*, *B. typhosus*, *B. prodigiosus*, and *Ps. pyocyanea*. Table 1 shows the results of this test.

TABLE 1.—One quart of formalin and 13 ounces of potassium permanganate per 1,000 cubic feet in laboratory room. Space, 348 cubic feet. Surface exposure.

Culture.	Time.	Test.		Control.		Reinoculation.	
		Gro'th	No Gro'th	Gro'th	No Gro'th	Gro'th	No Gro'th
<i>Bact. anthracis</i>	1 hour	0	4	4	0	3	1
<i>B. subtilis</i>	1 hour	0	4	4	0	3	1
<i>M. pyogenes aureus</i>	1 hour	0	4	4	0	4	0
<i>Ps. pyocyanea</i>	1 hour	1	3	4	0	3	0
<i>B. typhosus</i>	1 hour	0	4	4	0	4	0
<i>Bact. anthracis</i>	1½ hours	0	4	4	0	4	0
<i>B. subtilis</i>	1½ hours	0	4	4	0	3	0
<i>M. pyogenes aureus</i>	1½ hours	0	4	4	0	4	0
<i>Ps. pyocyanea</i>	1½ hours	0	4	4	0	4	0
<i>B. typhosus</i>	1½ hours	0	4	4	0	4	0
<i>Bact. anthracis</i>	2 hours	0	3	4	0	0	3
<i>B. subtilis</i>	2 hours	0	4	4	0	3	1
<i>M. pyogenes aureus</i>	2 hours	0	4	4	0	4	0
<i>Ps. pyocyanea</i>	2 hours	0	4	4	0	3	0
<i>B. typhosus</i>	2 hours	0	4	4	0	4	0

TABLE 1.—One quart of formalin and 15 ounces of potassium permanganate per 1,000 cubic feet in laboratory room. Space, 2½ cubic feet. Surface exposure.—Continued.

Culture.	Time.	Test.		Control.		Reinoculation.	
		Gro'th	No Gro'th	Gro'th	No Gro'th	Gro'th	No Gro'th
Bact. anthracis.....	2½ hours	0	4	4	0	3	1
B. subtilis.....	2½ hours	0	4	4	0	4	0
M. pyogenes aureus.....	2½ hours	0	4	4	0	3	1
Ps. pyocyanea.....	2½ hours	0	3	4	0	3	0
B. typhosus.....	2½ hours	0	4	4	0	4	0
Bact. anthracis.....	3 hours	0	4	4	0	4	0
B. subtilis.....	3 hours	0	4	4	0	4	0
M. pyogenes aureus.....	3 hours	0	4	4	0	4	0
Ps. pyocyanea.....	3 hours	0	3	4	0	4	0
B. typhosus.....	3 hours	0	3	4	0	3	0

Ninety-five of the ninety-six cultures exposed were sterilized; nineteen in one hour, and twenty in one and one half hours; but not all of these tubes showed growth after reinoculation. This was probably due to the fact that the papers on which the cultures were exposed were very large, one inch by one fourth of an inch, and consequently such a large amount of formaldehyd was introduced into the bouillon that it ceased to be a good culture medium. In subsequent experiments the size of the paper was reduced to one eighth of an inch, and the reinoculations always showed growth thereafter.

The formalin used in this experiment was some that had been in the laboratory for months and showed a strength of 33.7 per cent of formaldehyd by the method recommended and described by Rosenau.²

The second test was made in the same room, with the same amount of chemicals and for three hours, and was an exact repetition of the first, except that the papers used were smaller. Its results are shown in Table 2. Of one hundred and forty-three cultures exposed, none showed growth after three hours.

TABLE 2.—One quart of formalin and 15 ounces of potassium permanganate per 1,000 cubic feet in laboratory room. Space, 2½ cubic feet. Surface exposure.

Culture.	Time.	Test.		Control.		Reinoculation.	
		Gro'th	No Gro'th	Gro'th	No Gro'th	Gro'th	No Gro'th
Bact. anthracis.....	1 hour	0	4	4	0	3	0
B. subtilis.....	1 hour	0	4	4	0	4	0
Bact. diphtheriæ.....	1 hour	0	4	2	2	4	0
M. pyogenes aureus.....	1 hour	0	4	4	0	3	1
Ps. pyocyanea.....	1 hour	0	4	4	0	4	0
B. typhosus.....	1 hour	0	3	4	0	3	0
Bact. anthracis.....	1½ hours	0	4	4	0	4	0
B. subtilis.....	1½ hours	0	4	4	0	4	0
Bact. diphtheriæ.....	1½ hours	0	4	2	2	4	0
M. pyogenes aureus.....	1½ hours	0	4	4	0	4	0
Ps. pyocyanea.....	1½ hours	0	4	4	0	4	0
B. typhosus.....	1½ hours	0	4	4	0	4	0

² Rosenau, M. J., *loc. cit.*

TABLE 2.—One quart of formalin and 15 ounces of potassium permanganate per 1,000 cubic feet in laboratory room. Space, 348 cubic feet. Surface exposure.—Continued.

Culture.	Time.	Test.		Control.		Reinoculation.	
		Gro'th	No Gro'th	Gro'th	No Gro'th	Gro'th	No Gro'th
Bact. anthracis.....	2 hours	0	4	4	0	4	0
B. subtilis.....	2 hours	0	4	4	0	4	0
Bact. diphtheriæ.....	2 hours	0	4	2	2	4	0
M. pyogenes aureus.....	2 hours	0	4	4	0	3	0
Ps. pyocyanea.....	2 hours	0	4	4	0	4	0
B. typhosus.....	2 hours	0	4	4	0	4	0
Bact. anthracis.....	2½ hours	0	4	4	0	4	0
B. subtilis.....	2½ hours	0	4	4	0	3	0
Bact. diphtheriæ.....	2½ hours	0	4	2	2	4	0
M. pyogenes aureus.....	2½ hours	0	4	4	0	3	1
Ps. pyocyanea.....	2½ hours	0	4	4	0	4	0
B. typhosus.....	2½ hours	0	4	4	0	4	0
Bact. anthracis.....	3 hours	0	8	4	0	8	0
B. subtilis.....	3 hours	0	8	4	0	8	0
Bact. diphtheriæ.....	3 hours	0	8	2	2	7	0
M. pyogenes aureus.....	3 hours	0	8	4	0	5	1
Ps. pyocyanea.....	3 hours	0	8	4	0	8	0
B. typhosus.....	3 hours	0	8	4	0	8	0

The third test was made under the same conditions to try the penetrating power of the formaldehyd gas. Cultures were exposed as before on paper in Petri dishes, but the Petri dishes were put between the folds of a sterilized woolen blanket and a sterilized sheet, and on the floor under a piece of carpet and into a closed drawer. The results of this test are shown in Table 3.

TABLE 3.—One quart of formalin and 15 ounces of potassium permanganate per 1,000 cubic feet in laboratory room. Space, 348 cubic feet. Time, 3 hours.

Culture.	Test.		Control.		Exposed under
	Gro'th	No Gro'th	Gro'th	No Gro'th	
Bact. anthracis.....	0	4	3	1	1 layer of blanket.
B. subtilis.....	0	4	4	0	
Bact. diphtheriæ.....	0	4	4	0	
M. pyogenes aureus.....	0	4	4	0	
Ps. pyocyanea.....	0	4	4	0	
B. typhosus.....	0	4	4	0	
Bact. anthracis.....	0	4	3	1	2 layers of blanket.
B. subtilis.....	4	0	4	0	
Bact. diphtheriæ.....	0	4	4	0	
M. pyogenes aureus.....	3	1	4	0	
Ps. pyocyanea.....	0	4	4	0	
B. typhosus.....	0	4	4	0	
Bact. anthracis.....	4	0	3	1	3 layers of blanket.
B. subtilis.....	3	0	4	0	
Bact. diphtheriæ.....	0	4	4	0	
M. pyogenes aureus.....	2	2	4	0	
Ps. pyocyanea.....	4	0	4	0	
B. typhosus.....	0	4	4	0	

TABLE 3.—One quart of formalin and 13 ounces of potassium permanganate per 1,000 cubic feet in laboratory room. Space, 348 cubic feet. Time, 3 hours.—Continued.

Culture.	Test.		Control.		Exposed under
	Gro'th	No Gro'th	Gro'th	No Gro'th	
Bact. anthracis.....	4	0	3	1	4 layers of blanket.
B. subtilis.....	4	0	4	0	
Bact. diphtheriæ.....	0	4	4	0	
M. pyogenes aureus.....	2	1	4	0	
Ps. pyocyanea.....	4	0	4	0	
B. typhosus.....	2	2	4	0	
Bact. anthracis.....	4	0	3	1	6 layers of blanket.
B. subtilis.....	4	0	4	0	
Bact. diphtheriæ.....	4	0	4	0	
M. pyogenes aureus.....	3	0	4	0	
Ps. pyocyanea.....	4	0	4	0	
B. typhosus.....	3	1	4	0	
Bact. anthracis.....	4	0	4	0	8 layers of blanket.
B. subtilis.....	4	0	4	0	
Bact. diphtheriæ.....	3	0	4	0	
M. pyogenes aureus.....	3	0	4	0	
Ps. pyocyanea.....	4	0	4	0	
B. typhosus.....	3	0	4	0	
Bact. anthracis.....	4	0	3	1	10 layers of blanket.
B. subtilis.....	4	0	4	0	
Bact. diphtheriæ.....	4	0	4	0	
M. pyogenes aureus.....	4	0	4	0	
Ps. pyocyanea.....	4	0	4	0	
B. typhosus.....	4	0	4	0	
Bact. anthracis.....	0	4	3	1	1 layer of sheet.
B. subtilis.....	0	4	4	0	
Bact. diphtheriæ.....	0	4	4	0	
M. pyogenes aureus.....	0	4	4	0	
Ps. pyocyanea.....	0	4	3	1	
B. typhosus.....	0	4	4	0	
Bact. anthracis.....	0	4	3	1	2 layers of sheet.
B. subtilis.....	0	4	4	0	
Bact. diphtheriæ.....	0	4	4	0	
M. pyogenes aureus.....	0	4	4	0	
Ps. pyocyanea.....	0	4	3	1	
B. typhosus.....	0	4	4	0	
Bact. anthracis.....	0	4	3	1	3 layers of sheet.
B. subtilis.....	0	4	4	0	
Bact. diphtheriæ.....	0	4	4	0	
M. pyogenes aureus.....	0	4	4	0	
Ps. pyocyanea.....	0	4	3	1	
B. typhosus.....	0	4	4	0	
Bact. anthracis.....	0	4	3	1	4 layers of sheet.
B. subtilis.....	2	2	4	0	
Bact. diphtheriæ.....	0	4	4	0	
M. pyogenes aureus.....	0	3	4	0	
Ps. pyocyanea.....	1	7	3	1	
B. typhosus.....	0	4	4	0	
Bact. anthracis.....	4	0	3	1	6 layers of sheet.
B. subtilis.....	4	0	4	0	
M. pyogenes aureus.....	0	4	4	0	
Ps. pyocyanea.....	1	3	3	1	
Bact. diphtheriæ.....	0	4	4	0	
B. typhosus.....	0	4	4	0	

TABLE 3.—One quart of formalin and 18 ounces of potassium permanganate per 1,000 cubic feet in laboratory room. Space, 348 cubic feet. Time, 3 hours.—Continued.

Culture.	Test.		Control.		Exposed Under.
	Gro'th	No Gro'th	Gro'th	No Gro'th	
Bact. anthracis.....	0	4	4	0	8 layers of sheet.
B. subtilis.....	4	0	4	0	
Bact. diphtheriæ.....	0	4	4	0	
M. pyogenes aureus.....	1	3	4	0	
Ps. pyocyanea.....	3	1	3	1	
B. typhosus.....	0	4	4	0	10 layers of sheet.
Bact. anthracis.....	4	0	3	1	
B. subtilis.....	4	0	4	0	
Bact. diphtheriæ.....	0	3	4	0	
M. pyogenes aureus.....	4	0	4	0	
Ps. pyocyanea.....	1	3	3	1	1 layer of carpet.
B. typhosus.....	0	4*	4	0	
Ps. pyocyanea.....	0	4	4	0	
Bact. anthracis.....	0	3	4	0	In a closed drawer.
B. subtilis.....	0	4	4	0	
Bact. diphtheriæ.....	0	4	4	0	
B. typhosus.....	0	4	4	0	
M. pyogenes aureus.....	0	4	4	0	
Ps. pyocyanea.....	0	4	4	0	

*1 contaminated.

All of the cultures (24) were killed through one layer of blanket, all but the spore bearers and *M. pyogenes aureus* through two layers, but only such easily killed ones as *Bact. diphtheriæ* and *B. typhosus* through three layers, and there was no disinfecting action at all through more than four layers. Through the sheet, penetration was somewhat better. Sterilization was complete through two layers, and only the spore bearers survived when protected by four layers of sheeting. Under one layer of carpet the spore bearers were not harmed at all, and two out of the sixteen cultures of non-spore bearers survived. The inside of the closed drawer was disinfected, even though it was a dead space, and there was no artificial means of moving the air about.

Rosenau,⁴ in his bulletin, calls attention to the fact that the formalin may inhibit the growth of organisms without actually killing them. He made it a practice to neutralize the formaldehyd with ammonia before planting the papers in bouillon. To make sure that no such error was creeping into the results of these tests, thirty-nine cultures were exposed freely to the action of the formaldehyd for three hours. At the end of that time twenty-two of these papers were exposed for a few seconds to the action of ammonia gas and then all of them were planted in bouillon and incubated. There was no growth in any of the thirty-nine tubes.

⁴ Rosenau, M. J., *loc. cit.*

TABLE 4.—One quart of formalin and 13 ounces of potassium permanganate per 1,000 cubic feet in laboratory room. Space, 348 cubic feet. Formalin neutralised by ammonia. Time, 3 hours.

Culture.	Exposed to Ammonia.		Not Exposed to Ammonia.		Control.	
	Gro'th	No Gro'th	Gro'th	No Gro'th	Gro'th	No Gro'th
Bact. anthracis	0	4	0	3	3	1
B. subtilis	0	4	0	3	4	0
Bact. diphtheria	0	4	0	2	4	0
M. pyogenes aureus	0	2	0	3	4	0
Ps. pyocyanea	0	4	0	4	4	0
B. typhosus	0	4	0	2	4	0

Next it was decided to see whether this method of disinfecting would be equally effectual in an ordinary dwelling house. The room used was a living room containing all of its furniture. It had two doors and three windows, on two sides of the room. These windows were of the loose-fitting French kind so common in California houses, and the only attempt that was made to make the room less leaky was to stuff towels into the cracks through which came a very perceptible draft, and into the crack under the outer door. Cultures were exposed in various parts of the room, and at various distances from the floor, in order to make sure that the gas penetrated to every corner of the room. One set of Petri dishes was placed on a ledge of the very leaky window, one was put under the carpet on the floor, one under two and one under four layers of heavy woolen blanket, and one under a loose pile of magazines and papers. The results of this test are shown in Table 5.

TABLE 5.—One quart of formalin and 13 ounces of potassium permanganate per 1,000 cubic feet in room of dwelling house. Space, 1,686 cubic feet. Time, 3 hours.

Culture.	Test.		Control.		Reinoculation.		Conditions of Exposure.
	Gro'th	No Gro'th	Gro'th	No Gro'th	Gro'th	No Gro'th	
B. typhosus	0	3	3	1	4	0	On a table in the middle of room.
Bact. anthracis	0	3	4	0	3	0	
M. pyogenes aureus	0	4	4	0	4	0	
B. subtilis	0	4	4	0	4	0	
Mixed throat culture	0	4	4	0	—	—	
Ps. pyocyanea	0	3	4	0	3	0	On the floor in a corner between two windows.
B. subtilis	0	3	4	0	4	0	
Bact. anthracis	0	4	4	0	4	0	
Mixed throat culture	0	4	4	0	—	—	
M. pyogenes aureus	0	4	4	0	4	0	
Ps. pyocyanea	0	4	4	0	4	0	
B. typhosus	0	4	3	1	4	0	
Bact. anthracis	0	4	4	0	4	0	On bookshelves in corner between two windows.
B. subtilis	0	3	4	0	3	0	
Mixed throat culture	0	4	4	0	—	—	
M. pyogenes aureus	0	4	4	0	4	0	
Ps. pyocyanea	0	4	4	0	4	0	
B. typhosus	0	4	3	1	4	0	On a ledge above the window.
Bact. anthracis	0	4	4	0	4	0	
B. subtilis	0	4	4	0	4	0	
Mixed throat culture	0	4	4	0	—	—	
M. pyogenes aureus	0	4	4	0	4	0	
B. typhosus	0	4	3	1	4	0	

TABLE 5.—One quart of formalin and 13 ounces of potassium permanganate per 1,000 cubic feet in room of dwelling house. Space, 1,686 cubic feet. Time, 3 hours.—Continued.

Culture.	Test.		Control.		Reinoculation.		Conditions of Exposure.
	Gro'th	No Gro'th	Gro'th	No Gro'th	Gro'th	No Gro'th	
Bact. anthracis	1	0	4	0	--	--	On sill of a leaky window.
B. subtilis	0	4	4	0	4	0	
Mixed throat culture	0	4	4	0	--	--	
M. pyogenes aureus	0	4	4	0	4	0	
Ps. pyocyanea	0	7	4	0	7	0	
B. typhosus	0	5	3	1	5	0	
Bact. anthracis	0	4	4	0	4	0	On bookshelves about four feet from floor.
B. subtilis	0	4	4	0	4	0	
Mixed throat culture	0	4	4	0	--	--	
Ps. pyocyanea	0	4	4	0	4	0	
B. typhosus	0	7	3	1	7	0	
Bact. anthracis	0	4	4	0	4	0	Under 1 layer of a felt table cover that had holes in it.
B. subtilis	0	4	4	0	4	0	
Mixed throat culture	0	4	4	0	--	--	
M. pyogenes aureus	0	4	4	0	4	0	
Ps. pyocyanea	0	4	4	0	3	1	
B. typhosus	0	5	3	1	5	0	
Bact. anthracis	0	4	4	0	4	0	Under 2 layers of a heavy wool blanket.
B. subtilis	0	3	4	0	3	0	
Mixed throat culture	1	3	4	0	--	--	
M. pyogenes aureus	1	3	4	0	3	0	
Ps. pyocyanea	0	4	4	0	4	0	
B. typhosus	0	4	3	1	4	0	
Bact. anthracis	4	0	4	0	--	--	Under 4 layers of a heavy wool blanket.
B. subtilis	4	0	4	0	2	0	
Mixed throat culture	1	3	4	0	--	--	
M. pyogenes aureus	1	3	4	0	2	0	
Ps. pyocyanea	4	0	4	0	--	--	
B. typhosus	0	3	3	1	--	--	
Bact. anthracis	4	0	4	0	--	--	Under 1 layer of carpet on the floor.
B. subtilis	4	0	3	0	--	--	
Mixed throat culture	2	2	4	0	--	--	
M. pyogenes aureus	0	3	4	0	3	0	
Ps. pyocyanea	3	1	4	0	1	0	
B. typhosus	0	4	3	1	4	0	
Bact. anthracis	3	0	4	0	--	--	Under a loose pile of papers and magazines on the floor.
B. subtilis	0	2	4	0	2	0	
Mixed throat culture	0	4	4	0	--	--	
M. pyogenes aureus	0	4	4	0	3	0	
Ps. pyocyanea	2	2	4	0	2	0	
B. typhosus	1	3	3	0	2	0	

Of one hundred and fifty-nine cultures exposed to the gas with nothing over them, one hundred and fifty-eight were killed. The one that grew was an anthrax culture exposed on the ledge of the leaky window. Disinfection was incomplete under the carpet and in the pile of papers; and the formaldehyd did not penetrate the folds of blanket any better than in the preceding experiment. Evidently in practical disinfection it would be necessary to take up the carpet, and to spread out all bedding and clothes. At the end of the three hours the room was allowed to air, but it was found, even on the next day, impossible to occupy it with any comfort. At the end of that time flat dishes of ammonia were

set around in it, and in an hour or so the smell of formaldehyd had practically disappeared.

The results of the disinfection with this amount of formalin had been so uniformly satisfactory that it was decided to see whether it could not be cut down without impairing the efficiency of the process. It was decided to try the effect of one pint of formalin and six and one-half ounces of potassium permanganate to a thousand cubic feet of space. Two tests with this amount were made in the laboratory room (Tables 6 and 7), and one in the room of a house. This was a room of ordinarily tight finish, with two doors and two windows. As in the other room, no attempt was made to seal up cracks, nor to make it air tight in any way, except that the keyhole was plugged. The smell of formaldehyd was very strong in all the other rooms on the same floor. The results of using this reduced amount of formalin are shown in Tables 6, 7, and 8.

TABLE 6.—One pint of formalin and 6½ ounces of potassium permanganate per 1,000 cubic feet in laboratory room. Space, 3½8 cubic feet.

Culture.	Time.	Test.		Reinoculation.		Conditions of Exposure.
		Gro'th	No Gro'th	Gro'th	No Gro'th	
Bact. anthracis	1 hour	0	4	3	0	On surface.
B. subtilis	1 hour	0	4	4	0	
M. pyogenes aureus	1 hour	0	4	4	0	
Ps. pyocyanea	1 hour	1	3	3	0	
B. typhosus	1 hour	0	4	4	0	
B. prodigiosus	1 hour	0	2	2	0	
Bact. anthracis	1½ hours	0	4	4	0	On surface.
B. subtilis	1½ hours	0	4	4	0	
M. pyogenes aureus	1½ hours	0	4	4	0	
Ps. pyocyanea	1½ hours	0	3	3	0	
B. typhosus	1½ hours	0	3	3	0	
B. prodigiosus	1½ hours	0	4	4	0	
Bact. anthracis	2 hours	0	4	4	0	On surface.
B. subtilis	2 hours	0	4	4	0	
M. pyogenes aureus	2 hours	0	4	4	0	
Ps. pyocyanea	2 hours	1	3	3	0	
B. typhosus	2 hours	0	4	4	0	
B. prodigiosus	2 hours	0	3	3	0	
Bact. anthracis	2½ hours	0	4	4	0	On surface.
B. subtilis	2½ hours	0	4	4	0	
M. pyogenes aureus	2½ hours	0	3	3	0	
Ps. pyocyanea	2½ hours	0	4	4	0	
B. typhosus	2½ hours	0	4	4	0	
B. prodigiosus	2½ hours	0	4	4	0	
Bact. anthracis	3 hours	0	4	4	0	On surface.
B. subtilis	3 hours	0	4	4	0	
M. pyogenes aureus	3 hours	0	4	4	0	
Ps. pyocyanea	3 hours	0	4	4	0	
B. prodigiosus	3 hours	0	4	3	0	
B. typhosus	3 hours	0	3	3	0	
Bact. anthracis	3 hours	0	4	3	0	Under 1 layer of sheet.
B. subtilis	3 hours	1	3	4	0	
M. pyogenes aureus	3 hours	0	3	4	0	
Ps. pyocyanea	3 hours	1	3	2	0	
B. typhosus	3 hours	0	4	4	0	
B. prodigiosus	3 hours	0	4	4	0	

TABLE 6.—One pint of formalin and 6½ ounces of potassium permanganate per 1,000 cubic feet in laboratory room. Space, 348 cubic feet.—Continued.

Culture.	Time.	Test.		Reinoculation.		Conditions of Exposure.
		Gro'th	No Gro'th	Gro'th	No Gro'th	
Bact. anthracis	3 hours	0	4	2	0	Under 2 layers of sheet.
B. subtilis	3 hours	0	4	4	0	
M. pyogenes aureus	3 hours	0	4	4	0	
Ps. pyocyanea	3 hours	0	4	4	0	
B. typhosus	3 hours	0	4	4	0	
B. prodigiosus	3 hours	0	4	4	0	Under 3 layers of sheet.
Bact. anthracis	3 hours	0	3	3	0	
B. subtilis	3 hours	0	4	3	0	
M. pyogenes aureus	3 hours	0	4	3	0	
Ps. pyocyanea	3 hours	0	4	4	0	
B. typhosus	3 hours	0	4	3	0	Under 4 layers of sheet.
B. prodigiosus	3 hours	0	3	3	0	
Bact. anthracis	3 hours	0	4	4	0	
B. subtilis	3 hours	1	3	3	0	
M. pyogenes aureus	3 hours	0	4	4	0	
Ps. pyocyanea	3 hours	0	4	4	0	Under 2 layers of blanket.
B. typhosus	3 hours	0	4	3	0	
B. prodigiosus	3 hours	0	4	4	0	
Bact. anthracis	3 hours	0	4	3	0	
B. typhosus	3 hours	0	4	4	0	
M. pyogenes aureus	3 hours	0	4	4	0	
Ps. pyocyanea	3 hours	1	3	3	0	
B. prodigiosus	3 hours	0	4	4	0	

TABLE 7.—One pint of formalin and 6½ ounces of potassium permanganate per 1,000 cubic feet in laboratory room. Temperature, 22° C. Weather windy.

Culture.	Time.	Test.		Control.		Reinoculation.		Conditions of Exposure.
		Gro'th	No Gro'th	Gro'th	No Gro'th	Gro'th	No Gro'th	
Bact. anthracis	1 hour	0	3	3	0	--	--	On surface.
B. subtilis	1 hour	0	4	4	0	4	0	
M. pyogenes aureus	1 hour	0	4	4	0	4	0	
Ps. pyocyanea	1 hour	0	4	4	0	--	--	
B. typhosus	1 hour	0	4	4	0	--	--	
B. prodigiosus	1 hour	0	4	4	0	4	0	On surface.
Bact. anthracis	1½ hours	0	4	3	0	4	0	
B. subtilis	1½ hours	0	4	4	0	4	0	
M. pyogenes aureus	1½ hours	0	4	4	0	4	0	
Ps. pyocyanea	1½ hours	0	4	4	0	4	0	
B. typhosus	1½ hours	0	3	4	0	3	0	On surface.
B. prodigiosus	1½ hours	0	4	4	0	4	0	
Bact. anthracis	2 hours	0	4	3	0	3	0	
B. subtilis	2 hours	0	4	4	0	4	0	
M. pyogenes aureus	2 hours	0	4	4	0	--	--	
Ps. pyocyanea	2 hours	0	4	4	0	4	0	On surface.
B. typhosus	2 hours	0	4	4	0	4	0	
B. prodigiosus	2 hours	0	4	4	0	--	--	

TABLE 7.—One pint of formalin and 6½ ounces of potassium permanganate per 1,000 cubic feet in laboratory room. Temperature, 25° C. Weather windy.—Continued.

Culture.	Time.	Test.		Control.		Reinoculation.		Conditions of Exposure.
		Gro'th	No Gro'th	Gro'th	No Gro'th	Gro'th	No Gro'th	
Bact. anthracis	2½ hours	0	4	4	0	—	—	On surface.
B. subtilis	2½ hours	0	4	4	0	3	0	
M. pyogenes aureus	2½ hours	0	4	4	0	—	—	
Ps. pyocyanea	2½ hours	0	3	3	0	3	0	
B. typhosus	2½ hours	0	4	4	0	—	—	
B. prodigiosus	2½ hours	0	4	4	0	3	0	On surface.
Bact. anthracis	3 hours	0	4	4	0	3	0	
B. subtilis	3 hours	0	4	4	0	4	0	
M. pyogenes aureus	3 hours	0	4	4	0	—	—	
Ps. pyocyanea	3 hours	0	4	4	0	—	—	
B. typhosus	3 hours	0	4	4	0	4	0	
B. prodigiosus	3 hours	0	4	4	0	4	0	Under 1 layer of blanket.
Bact. anthracis	3 hours	0	4	3	0	4	0	
M. pyogenes aureus	3 hours	0	4	4	0	2	2	
B. typhosus	3 hours	0	4	4	0	4	0	
B. prodigiosus	3 hours	0	4	4	0	4	0	Under 2 layers of blanket.
Bact. anthracis	3 hours	1	3	3	0	3	0	
M. pyogenes aureus	3 hours	0	4	4	0	1	2	
Ps. pyocyanea	3 hours	1	3	4	0	2	0	
B. typhosus	3 hours	0	4	4	0	4	0	
B. prodigiosus	3 hours	0	4	4	0	4	0	Under 3 layers of blanket.
Bact. anthracis	3 hours	4	0	4	0	—	—	
B. subtilis	3 hours	3	1	4	0	—	—	
M. pyogenes aureus	3 hours	0	2	4	0	—	—	
Ps. pyocyanea	3 hours	4	0	4	0	—	—	
B. typhosus	3 hours	0	4	4	0	—	—	Under 4 layers of blanket.
B. prodigiosus	3 hours	0	4	4	0	—	—	
Bact. anthracis	3 hours	3	0	4	0	—	—	Under 1 layer of sheet.
Ps. pyocyanea	3 hours	4	0	4	0	—	—	
Bact. anthracis	3 hours	0	8	3	0	—	—	Under 2 layers of sheet.
M. pyogenes aureus	3 hours	0	4	4	0	—	—	
Ps. pyocyanea	3 hours	0	4	4	0	4	0	
B. typhosus	3 hours	0	6	4	0	—	—	
B. prodigiosus	3 hours	0	4	4	0	—	—	
Bact. anthracis	3 hours	0	4	3	0	—	—	Under 3 layers of sheet.
M. pyogenes aureus	3 hours	0	4	4	0	—	—	
Ps. pyocyanea	3 hours	0	4	4	0	—	—	
B. typhosus	3 hours	0	4	4	0	—	—	
B. prodigiosus	3 hours	0	4	4	0	—	—	
Bact. anthracis	3 hours	0	3	3	0	—	—	Under 4 layers of sheet.
M. pyogenes aureus	3 hours	0	4	4	0	—	—	
Ps. pyocyanea	3 hours	0	4	4	0	3	0	
B. typhosus	3 hours	0	4	4	0	—	—	
B. prodigiosus	3 hours	0	4	4	0	—	—	
Bact. anthracis	3 hours	0	4	4	0	—	—	Under 4 layers of sheet.
Ps. pyocyanea	3 hours	0	4	4	0	—	—	
M. pyogenes aureus	3 hours	0	4	4	0	—	—	
B. typhosus	3 hours	0	4	4	0	4	0	
B. prodigiosus	3 hours	0	4	4	0	4	0	

TABLE 8.—One pint of formalin and 6½ ounces of potassium permanganate per 1,000 cubic feet in dwelling house. Space, 979 cubic feet. Time, 3 hours. Temperature, 20° C.

Culture.	Test.		Control.		Conditions of Exposure.
	Gro'th	No Gro'th	Gro'th	No Gro'th	
Bact. anthracis	0	4	3	0	Beside a window on level of window sill.
B. subtilis	0	4	4	0	
M. pyogenes aureus	0	4	4	0	
Ps. pyocyanea	0	4	4	0	
B. typhosus	0	4	4	0	
B. prodigiosus	0	4	4	0	
Bact. anthracis	0	4	4	0	In a partially open drawer.
B. subtilis	0	8	4	0	
M. pyogenes aureus	0	3	4	0	
Ps. pyocyanea	0	4	4	0	
B. typhosus	0	4	4	0	
B. prodigiosus	0	4	4	0	
Bact. anthracis	0	3	3	0	On the floor in a corner.
B. subtilis	0	4	4	0	
M. pyogenes aureus	0	4	4	0	
Ps. pyocyanea	0	3	4	0	
Bact. anthracis	0	4	4	0	On a table.
B. subtilis	0	4	4	0	
M. pyogenes aureus	0	4	4	0	
Ps. pyocyanea	0	4	4	0	
B. typhosus	0	4	4	0	
B. prodigiosus	0	4	4	0	
Bact. anthracis	0	4	3	0	On a bed, under one layer of blanket.
B. subtilis	3	1	4	0	
M. pyogenes aureus	0	4	4	0	
Ps. pyocyanea	0	4	4	0	
B. typhosus	0	4	4	0	
B. prodigiosus	0	4	4	0	
Bact. anthracis	0	4	4	0	On a bed, under two layers of blanket.
B. subtilis	0	4	4	0	
M. pyogenes aureus	1	3	4	0	
B. typhosus	1	3	4	0	
B. prodigiosus	0	4	4	0	
B. subtilis	0	4	4	0	
Bact. anthracis	0	4	4	0	Under a blanket thrown over the back of a chiffonier.
B. subtilis	0	4	4	0	
M. pyogenes aureus	0	4	4	0	
Ps. pyocyanea	0	4	4	0	
B. typhosus	0	4	4	0	
B. prodigiosus	0	4	4	0	
B. typhosus	1*	3	4	0	
Bact. anthracis	0	4	3	0	On floor, under one layer of blanket.
M. pyogenes aureus	0	4	4	0	
Ps. pyocyanea	0	4	4	0	
B. typhosus	0	4	4	0	
B. prodigiosus	0	4	4	0	
B. subtilis	1	3	4	0	

* Contamination.

For free exposures, sterilization was complete for three hundred and seventeen out of three hundred and nineteen cultures. The two that grew were two cultures of *Ps. pyocyanea* exposed, one for one hour and one for two hours. Sterilization was complete through four layers of sheet, except for one case out of a total of forty-three cultures exposed.

Of thirty-seven cultures exposed under one layer of blankets, thirty-four were killed, the other three being cultures of *Bact. anthracis*. Under two layers of blanket fifty-five cultures were exposed, and five grew afterwards.

As a result of this set of experiments, it would seem that one pint of formalin and six and one half ounces of potassium permanganate per one thousand cubic feet of space is certainly a safe receipt for disinfection under the conditions which are to be met with here. How much of a margin of safety this allows has not been determined by this limited series of experiments, except that one hour's exposure seems to have given as complete disinfection as three hours. In all cases it is necessary to spread out, or hang up, blankets and clothing and to take up the carpets.

These experiments were carried on in Berkeley, in the summer time, from June to September, when the weather is cool and very damp. There is some doubt whether the same tests repeated in the hot, dry interior of the State would result in the same way, so a further course of experiments has been planned to settle this point, and to determine the best amount of formalin for a dry climate.

We have also planned to do some work to determine the efficiency of disinfection with the various forms of solidified formaldehyd, so commonly sold by druggists for that purpose.

THE NUMERICAL DETERMINATION OF LEUCOCYTES IN MILK.

By

ARCHIBALD R. WARD, B.S.A., D.V.M.

MARGARET HENDERSON, B.S.

CLARENCE M. HARING, D.V.M.

Mammitis in the cow, commonly called garget, is a matter of importance in its relation to the purity and wholesomeness of market milk. The rôle of streptococci as the cause of mammitis in the cow, and the probable relation of this affection to digestive disorders in infants, are both of vital interest in this connection.

Mammitis frequently appears without specific symptoms. Sometimes white caseous masses are noticed in otherwise normal milk, and often the milker first becomes aware of the existence of udder inflammation by noticing the masses of casein lodged on the milk-strainer. Pus is always present in the milk of cows so affected, but it is not always present in sufficient amount to attract attention. The insidious onset of mammitis renders it exceedingly difficult for even the most conscientious milk-dealer to exclude infected milk from the product sold by him. Slight catarrhal conditions of the udder mucosa may readily pass unnoticed.

The prevalence of mammitis among cows, and the difficulty of avoiding the marketing of milk infected with streptococci, have led to the development of microscopic tests of milk for the detection of mammitis.

Stokes¹ devised a microscopic examination of milk for pus cells and streptococci as a means of detecting the presence of mammitis among cows supplying the milk. Centrifugal sediment from 10 cubic centimeters of milk was strained and examined with a one-twelfth inch oil immersion lens. He regarded the presence in milk of an individual cow, of five cells per field of the oil immersion lens, as justification for excluding the animal from the herd.

Bergey² modified Stokes's method and made extensive examinations of the milk of individual cows. Parallel bacteriological examinations for both species and numbers supplemented his examinations for cells. He observes:

Cells can be demonstrated in the milk of practically all cows, and hence the number of these cells present in milk becomes a matter of importance. It is believed that the occurrence of ten cells per field of the one-twelfth immersion lens indicates the presence of pus in milk, especially if the cells occur in masses. The presence of pus in milk denotes an inflammatory reaction within the udder, from the fact that the pus is always associated with pyogenic organisms.

Streptococci were found in nearly all the samples of milk derived from cows which showed the presence of pus. These bacteria are usually the cause of catarrhal mammitis.

¹ Stokes. The microscopic examination of milk. Annual Report of the Health Department of the City of Baltimore, 1897, p. 105.

² Bergey. The source and nature of bacteria in milk. Bulletin No. 125, Department of Agriculture, Commonwealth of Pennsylvania.

Streptococci and pus cells were also encountered in samples of milk derived from cows in which no inflammation of the udder could be discovered. This occurrence is probably due to the fact that the disease was not very active, or that it had persisted for a considerable time and become chronic.

Stewart³, of the Philadelphia Bureau of Health, further modified the method so that it was practicable to use it for the examination of large numbers of samples of mixed herd milk. Stewart describes the apparatus and method as follows:

This apparatus consists of a circular pan about 12 inches in diameter, and $\frac{3}{4}$ inch deep, containing twenty small glass tubes. The tubes contain 1 c.c. of milk and are filled by means of a small bulb similar to that ordinarily used on medicine droppers. The end of the tube is closed by a small rubber stopper, and the tubes are held in the pan by spring clamps. This pan is fitted upon the ordinary Boekel water centrifuge and covered with a lid which is held down by a thumbscrew. The pan covered in this way furnishes a surface of very slight resistance to the atmosphere during its revolution, somewhat on the principle of a child's top.

By the old method the arms of the centrifuge containing the milk encountered so much resistance in their revolution that the speed with 15 pounds water pressure was not more than 1,200 revolutions per minute, while the speed obtained with the new apparatus is from 2,500 to 3,000 revolutions per minute with 15 pounds pressure. This rapid speed causes sedimentation to occur in less than five minutes. When this is completed the centrifuge pan can be lifted from the motor and the per cent of cream measured by a graduated scale marked upon the tube. The heavier matter, as the insoluble dirt, pus cells and bacteria, is thrown to the peripheral end of the tube, where it adheres to the rubber cork in the lumen of the tube. To examine this sediment, the cork is carefully removed and a spread made by rubbing the cork containing the sediment over an area of a square centimeter on a 3-inch by 6-inch glass slide. The proper area of the smear is obtained by placing underneath the slide a scale of circles having an area of a square centimeter. After the smears are dried in air without fixation of heat, the preparation is stained with the Jenner blood stain for two minutes, keeping the stain in constant motion. The excess of stain is washed off in water, and the preparation is dried in air. By this blood-staining method the pus and blood cells are stained perfectly and the ordinary microorganisms take the blue stain well.

The stained specimens are examined with a one-twelfth Leitz objective and a No. 3 eye-piece. The character of the bacteria is noted, and the average number of pus cells per field is counted. This average number is multiplied by 4,400, since there are about 4,400 fields to a square centimeter, as estimated by the stage micrometer. This result is approximately the number of pus cells per cubic centimeter of milk.

When a sample of milk showed over 100,000 cells per cubic centimeter, or showed "streptococci and the ordinary pus-producing organisms," an examination of the herd was ordered. The writer quoted figures showing that inspections of condemned herds by veterinarians confirmed the conclusions from laboratory work.

Doane⁴ felt the need for a more accurate quantitative method for determining leucocytes, and, with Dr. Buckley, devised the Doane-Buckley method. The process is described by Doane as follows:

With this method 10 cubic centimeters of milk are centrifuged for four minutes in graduated sedimentation tubes, at an approximate speed of 2,000 revolutions per minute. The cream is lifted out with a cotton swab, care being taken to get as much of the fat out as possible. It is then centrifuged for one minute more and the cream again removed with a cotton swab. Any fat remaining in the milk interferes seriously with the counting, as, if there are more than a few globules, they form a layer at the top of the liquid in the counting chamber, and as the leucocytes settle to the bottom of the chamber, it is difficult to see through the fat. It is only with cows giving milk difficult of separation where this trouble is experienced, and with such animals considerable care is necessary in removing all of the cream gathered at the top of the sedimentation tube. The method of removing the fat with cotton is the best one that has occurred to us, and it is the only part of the process that does not operate with entire satisfaction in every instance.

Following the removal of the cream, after the second centrifuging, the bottom of the tube will contain a portion of sediment which is easily seen. This sediment may, in

³ Stewart. Methods employed in the examination of milk by city health authorities. *American Medicine*, Vol. IX, No. 12, p. 486.

⁴ Doane. Leucocytes in milk, and their significance. Bulletin No. 102, Maryland Agricultural Experiment Station.

extreme cases of cows suffering with garget, amount to as much as one cubic centimeter. Ordinarily, it will be considerably less than one-half cubic centimeter. The amount varies considerably with the number of leucocytes, but not absolutely. The milk above this sediment is removed with a small siphon, which can be easily arranged with bent glass rods drawn to a fine point and supplied with a small rubber and a pinch cock. In using the siphon it is better to keep the point near the surface of the milk in the tube in order not to agitate the precipitated leucocytes and draw a number of them off with the milk. The milk in the tube may be siphoned within an eighth of an inch of the sediment in the tube. This will usually be below the $\frac{1}{2}$ c.c. mark. Two drops of a saturated alcoholic solution of methylene blue are then added, thoroughly mixed with the sediment by shaking, and then set in boiling water for two or three minutes to assist the leucocytes in taking up the color. The contents of the tube can be boiled by holding it directly in the flame, but it has no advantage over the use of the water bath, and it is very likely to break the glass. After heating, some water is added to the tube to render the color less dense. Ordinarily filling the tube to the 1 c.c. mark will be sufficient, and this quantity gives an easy factor for calculating the final results.

In putting this liquid, containing the leucocytes, into the blood counter, considerable care is necessary, owing to the tendency of the leucocytes to sink to the bottom. At this place a capillary tube was used, and the cover glass was held in one hand ready to cover the chamber as soon as the drop was transferred to the counter. After placing the glass cover over the chamber, about a minute is required to allow the leucocytes to settle to the bottom of the chamber. There are very few foreign bodies that are likely to be mistaken for leucocytes in counting. Ordinarily, the polynuclear leucocytes predominate and the stained nuclei, with the unstained surrounding cell, show up very distinctly. A few small leucocytes with large nuclei may be found, and these may be confounded with yeast cells until the worker becomes familiar with the distinction.

As regards counting, we have taken a standard with a cubic centimeter as a basis quantity of milk, though we are of course aware that the corpuscles in the blood are enumerated with a cubic millimeter basis. We adopted the centimeter largely for two reasons. In counting bacteria in the milk the cubic centimeter is always the basis employed. Simply because the leucocytes were derived from the blood seemed to be no reason why the same basis for counting should be employed as was used with the blood, while to the ordinary bacteriological worker, to whom this work will fall, if ever adopted to any extent, the cubic centimeter standard would be a little more easily comprehended, because more frequently used. The blood-counter holds one-tenth cubic millimeter, and one ten-thousandth cubic centimeter. If 10 cubic centimeters of milk are used, and 1 cubic centimeter of fluid is in the tube after siphoning, and the coloring matter and the water used to dilute have been added, then the resulting number of leucocytes in the counter multiplied by 1,000 will be the total number of leucocytes per cubic centimeter in the milk. If a total of 75 leucocytes was counted in the chamber, there would be 75,000 leucocytes per cubic centimeter in the milk.

In the actual counting under the microscope a square millimeter of the counting chamber will be found to be ruled off into 400 smaller equal squares. This facilitates an accurate and rapid count. Where the number of leucocytes is not great, the entire field can be counted in a short time. Where there is a great number of leucocytes a few squares or sets of squares in different parts of the ruled surface will give approximately the number.

There are occasionally a few variations desirable from these rules, but it may be well to state that the details have been pretty carefully and thoroughly worked over and compared, and it is seldom that short cuts can be made if correct results are desired. The time and speed of centrifuging are placed as low as possible for accurate work. Where there is one half centimeter or more of sediment, it is necessary to use more of the methylene blue for staining, and as there will be too great a number of leucocytes to make a satisfactory count in the counting chamber, it is better to add water until there are 2 cubic centimeters, or sometimes even more, in the sedimentation tube.

This method of counting, while long in explaining, is in reality comparatively short and simple in application. Moreover, it is based on accurate measurements in every detail, and the results are correspondingly reliable.

This method gives much higher results than that used by Stokes and by Bergey. The cows of the Maryland Agricultural Experiment Station averaged 113,760 leucocytes per cubic centimeter, while those of "one of the best and most carefully kept herds in the United States" averaged 241,578 per cubic centimeter. Doane was unable to determine any difference between those leucocytes and pus cells. He would regard the presence of 500,000 leucocytes per cubic centimeter as suspicious, and 1,000,000 per cubic centimeter as indicating inflammation of the udder. He writes:

In truth, counting leucocytes with the blood-counter, or in any way putting dependence on the number of leucocytes, is very unsatisfactory. The presence of fibrin, as

shown by clumps of leucocytes in the blood-counter, or, as demonstrated by stained threads, combined with an abnormal number of leucocytes, is the only satisfactory proof that inflammation exists in the udder.

Slack⁵ modified the Stewart method by using tubes of a larger bore, containing 2 cubic centimeters, and smeared the sediment over 4 square centimeters. He condemns when over fifty cells are seen to the field of a one-twelfth oil immersion objective. He condemns for streptococci, when streptococci, diplococci, or cocci are observed microscopically, if the observation is confirmed by the presence of streptococci in cultures from the same sample.

Savage⁶ devised a method similar to that of Doane and Buckley, which, like theirs, shows large numbers of leucocytes in the milk of normal cows. Savage can not distinguish between a leucocyte and a pus cell, nor does he set a standard to designate an abnormal number of pus cells.

The Stewart method was very slightly modified in the laboratory of the San Francisco Health Commission. The disk covered with tubes was fitted to a Bausch & Lomb centrifuge and a speed of 3,000 revolutions a minute was used. Milk of the various dealers was reported upon with respect to its content of streptococci, staphylococci, and pus.

It will be noted that there is a wide discrepancy between the different methods as regards the number of cells that should be regarded as indicating contamination by pus. Stewart condemns for 100,000 per cubic centimeter. Doane found the individual cows of a whole herd averaging twice this number and with hesitancy designated 500,000 leucocytes per cubic centimeter as suspicious. Doane used his method in judging the milk of individual cows, while the Stewart method was used to determine the quality of the mixed milk of whole herds. To detect the contamination introduced into the mixed milk of a herd by a few cows indicates a highly delicate test.

The variations between these methods and the prominence given the Stewart method in municipal laboratory work led us to conduct tests for the comparison of the two and for the comparison of duplicate determinations by each.

In our work with the Stewart method we used the apparatus devised by Stewart and made by Boekel of Philadelphia, fitted to our electric centrifuge capable of revolving 3,000 times a minute. For the numerical determinations by the use of the microscope, the relation borne by the area of one field to a square centimeter was determined by means of a stage micrometer. The precautions concerning the search of the whole area of the smear, as suggested by Stewart, were carried out. The Doane-Buckley method was carried out in strict accordance with the description quoted above.

The first numerical determinations of leucocytes were made by the Stewart method, on samples of market milk. By this method the total number of leucocytes in ten fields taken at random is observed. The average number per field is multiplied by a factor representing the relation of the area of the microscopic field to one square centimeter, the area of the smear. With our work this factor was 2173, 2332, or 2632,

⁵Slack. Methods of bacteriological examination of milk. The Journal of Infectious Diseases, Supplement No. 2, February, 1904, p. 214

⁶Savage. Streptococci and leucocytes in milk. Jour. Hyg. (Cambridge), (1906), No. 2, p. 123. Abs. in Experiment Station Record, Vol. XVII, No. 10, p. 1007.

depending upon the microscope used. Table 1 contains the figures showing the total of ten fields and the numerical determination obtained by multiplying the *average* number of leucocytes per field by the factor.

TABLE 1.—*A Series of Numerical Determinations of Leucocytes by the Stewart Method.*

Leucocytes in 10 Fields.	Leucocytes per c.c.	Leucocytes in 10 Fields.	Leucocytes per c.c.	Leucocytes in 10 Fields.	Leucocytes per c.c.
8	1,865	300	69,960	33	7,695
5	1,316	105	27,636	9	2,098
18	3,911	79	17,166	7	1,521
10	2,173	1	233	6	1,303
13	2,824	32	7,462	48	10,430
1	217	0	0,000	13	3,031
3	651	7	1,521	1	233
3	789	0	0,000	43	9,343
3	651	13	2,824	18	3,911
0	0,000	5	1,166	0	0,000
15	3,948	0	0,000	12	2,607
0	0,000	1	233	2	434
129	33,952	8	2,105	6	1,303
50	13,160	181	*47,639	14	3,264
9	1,555	19	4,128	3	651
11	2,895	32	6,953	19	4,430
2	526	4	869	0	0,000
14	3,042	4	1,052	7	1,632
11	2,390	3	789	3	652
17	4,474	0	000	6	1,303
26	5,649	0	000	43	10,027
64	3,907	1	233	11	2,565

The sixty-six determinations averaged 5,459 leucocytes per cubic centimeter. In nine cases no cells could be recognized, and the highest number found in 1 c.c. was 69,960. The cells occasionally were not uniformly distributed, and it was difficult to count them accurately when they occurred crowded closely together. In only one case were large numbers of leucocytes and streptococci found associated, and this is designated by a star. In about half of the examinations other organisms such as micrococci and short rods were found.

Other determinations were made with market milk, to compare the results by the Stewart and Doane-Buckley methods, and are recorded in Table 2. The numerical result by the Doane-Buckley method is obtained by counting the number of leucocytes in one ten-thousandth cubic centimeter (.0001 c.c.) of sediment from 10 cubic centimeters of the sample. The number counted is multiplied by 1,000 to give the number of leucocytes per cubic centimeter of the milk. The figures for the Stewart method have the same significance as in Table 1.

TABLE 2.—Numerical Determinations of Leucocytes in the Same Samples, by the Stewart and Doane-Buckley Methods.

Number.	STEWART.		DOANE-BUCKLEY.	Number.	STEWART.		DOANE-BUCKLEY.
	Leuco- cytes in 10 Fields.	Leuco- cytes per c.c.	Leucocytes per c.c.		Leuco- cytes in 10 Fields.	Leuco- cytes per c.c.	Leucocytes per c.c.
67.....	29	6,301	78,000	225.....	13	2,824	31,000
71.....	32	6,953	28,000	226.....	9	1,955	32,000
72.....	44	9,561	20,000	227.....	11	2,390	14,000
73.....	21	4,563	24,000	228.....	12	2,607	46,000
74.....	27	5,867	18,000	230.....	5	1,086	33,000
75.....	57	12,386	48,000	231.....	14	3,042	29,000
77.....	3	789	37,000	232.....	10	2,632	88,000
78.....	26	6,843	33,000	233.....	12	2,607	74,000
95.....	34	8,949	40,000	234.....	17	3,474	55,000
97.....	11	2,895	22,000	235.....	12	2,607	30,000
99.....	36	7,822	38,000	236.....	13	2,824	83,000
182.....	11	2,390	33,000	238.....	21	5,527	55,000
183.....	7	1,521	77,000	240.....	14	3,042	101,000
184.....	14	3,042	58,000	241.....	27	5,867	61,000
185.....	4	869	29,000	242.....	126	33,163	33,000
186.....	31	6,736	55,000	243.....	11	2,395	182,000
187.....	34	7,388	41,000	244.....	5	1,086	49,000
188.....	6	1,303	28,000	245.....	6	1,579	52,000
190.....	7	1,521	31,000	246.....	1	2,173	95,000
191.....	1	217	62,000	247.....	3	789	13,000
192.....	28	6,084	42,000	248.....	37	8,040	108,000
193.....	10	2,173	41,000	249.....	12	4,563	147,000
194.....	8	1,738	48,000	250.....	4	869	56,000
195.....	21	4,563	50,000	251.....	9	1,955	10,000
196.....	15	2,359	49,000	252.....	12	2,607	37,000
197.....	5	1,086	67,000	253.....	4	869	37,000
198.....	11	2,309	97,000	254.....	71	16,559	411,000
205.....	14	3,042	17,000	255.....	4	869	9,000
221.....	3	651	44,000	256.....	46	9,980	539,000
222.....	2	434	23,000				
224.....	9	1,955	38,000	Totals.....		254,290	3,824,000

The figures for the sixty determinations show that the results by the Doane-Buckley method average over fifteen times as large as those by the Stewart method. There is no constant ratio between the results by the two methods.

Another series of determinations was made with the view of comparing duplicate determinations by the Stewart method with one another, and of further comparing the results by this method with those of the Doane-Buckley method. The samples were taken directly from the teats of individual cows in a dairy, where extraordinary attention was paid to the health of the cows. The cows were all free from udder disease, except two cases of slight skin infection, which produced no perceptible effect in the leucocyte count. The numerical results may or may not represent the leucocyte count of the milk of the various cows, for the samples did not represent the whole of the mess of milk yielded by the cows. The series of determinations appearing in Table 3 then are of chief importance for comparing the three determinations from each sample. The fifth column in the table shows the percentage relation of the lower count by the Stewart method to the higher.

TABLE 3.—*Numerical Determinations of Leucocytes in the Same Samples by the Stewart Method and by the Doane-Buckley Method.*

STEWART.					DOANE-BUCKLEY.
First Count.		Second Count.		Per Cent Relation of Lower to Higher.	Leucocytes per c.c.
Leucocytes in 10 Fields.	Leucocytes per c.c.	Leucocytes in 10 Fields.	Leucocytes per c.c.		
34	7,388	8	1,738	23.5	34,000
0	0,000	0	0,000	-----	8,000
10	2,173	11	2,390	90.9	56,000
0	0,000	4	869	-----	46,000
3	651	9	1,955	33.3	28,000
0	000	0	0,000	-----	19,000
1	217	8	1,738	12.5	19,000
148	32,160	119	25,858	80.4	68,000
1	217	1	217	100.00	14,000
0	000	1	217	-----	4,000
2	434	4	869	50.0	99,000
4	869	1	217	25.0	90,000
6	1,303	11	2,390	54.5	37,000
89	23,424	6	1,303	5.5	336,000
18	3,911	27	5,867	66.6	194,000
0	0,000	0	0,000	-----	30,000
4	869	0	0,000	-----	151,000
0	000	0	0,000	-----	354,000
5	1,066	1	217	20.0	122,000
2	424	1	217	50.0	406,000
6	1,303	9	1,955	66.6	148,000
5	1,086	8	1,738	62.5	85,000
8	1,738	1	217	12.5	16,000
136	31,715	51	11,893	37.5	101,000
8	1,738	34	7,388	23.5	34,000
23	6,053	29	7,632	79.3	165,000
25	6,580	26	6,843	96.1	187,000
0	0,000	95	25,004	-----	5,000
6	1,579	30	7,896	19.8	379,000
0	0,000	1	217	-----	3,000
7	1,635	6	1,401	85.6	191,000
2	526	29	7,632	6.8	37,000
204	53,692	23	6,053	11.2	451,000
18	4,737	13	3,421	72.2	360,000
26	6,843	90	23,688	28.8	92,000
00	0,000	0	0,000	-----	58,000
48	12,633	24	6,316	50.0	155,000
23	6,053	32	8,422	71.8	92,000
22	5,790	51	13,423	43.1	237,000
Totals,	218,817	-----	187,201	-----	4,911,000
Averages,	5,610	-----	4,800	-----	125,820

The average number of leucocytes by the Stewart method in the first series is 5,610, in the second 4,800, and in the Doane-Buckley method 125,820. The averages of the Stewart counts do not show an especially convincing agreement, the second average being 85 per cent of the size of the first. Agreement is very much closer in the case of the averages of the two series than in the individual counts of pairs. In one case the count is the same in each series. Other cases vary from this high percentage of agreement to the pair that is farthest apart, 23,424 leucocytes per cubic centimeter for the first and 1,303 for the second count, the second showing but 5 per cent as many leucocytes in a cubic centimeter as the first. Except for one single instance throughout the table, the Doane-Buckley counts are much greater than the Stewart counts. The average of the Stewart counts shows 4 per cent as many leucocytes

per cubic centimeter as the average of the Doane-Buckley counts. The Stewart count that comes nearest to the corresponding Doane-Buckley count shows 15.6 per cent as many. The one count that comes farthest from agreeing shows 0.08 of one per cent.

A series of twenty-two determinations were made in duplicate by the Doane-Buckley method. In the case of the first two samples, two counts were made from the sediment and the numerical results of these are recorded as 1st and 2d drop, in Table 4. The closeness with which the two parallel determinations agree is shown in a column in which are figures showing the percentage relation of the lower to the higher determination.

TABLE 4.—*Numerical Determinations of Leucocytes in the Same Samples of Milk, in Duplicate, by the Doane-Buckley Method.*

Sample.	1 Leucocytes per c.c.	2 Leucocytes per c.c.	Per Cent Relation of Lower to Higher.
1.....	48,000 (1st drop)	35,000 (1st drop)	83.1
	29,000 (2d drop)	29,000 (2d drop)	
2.....	39,000 (1st drop)	40,000 (1st drop)	96.4
	42,000 (2d drop)	44,000 (2d drop)	
3.....	149,000	92,000	61.7
4.....	51,000	37,000	72.5
5.....	127,000	99,000	77.9
6.....	39,000	34,000	87.1
7.....	121,000	79,000	65.2
8.....	379,000	335,000	88.3
9.....	3,000	7,000	42.8
10.....	84,000	83,000	98.8
11.....	45,000	61,000	73.7
12.....	147,000	59,000	40.1
13.....	71,000	97,000	73.2
14.....	99,000	79,000	79.8
15.....	71,000	47,000	66.2
16.....	310,000	352,000	88.0
17.....	13,000	16,000	81.2
18.....	84,000	93,000	90.3
19.....	53,000	45,000	84.9
20.....	211,000	236,000	89.4
21.....	56,000	53,000	94.6
22.....	49,000	112,000	43.7
Totals	2,320,000	2,164,000	93.2
Averages	96,666	90,166	

The determinations from the 1st and 2d drops, in the first series, from sample 1 are discordant, but the other three duplicate drop counts are very close together. This line of work is treated more extensively in Table 5.

Thirteen determinations agreed within 25 per cent of the larger one, five within 35 per cent, and four more varied between 35 and 40 per cent.

Determinations 10 to 22 were made from the whole mess of milk of individual cows in the dairy of the University of California, and No. 8 was also made from the milk of an individual cow. The cows were all free from any apparent udder disease. This observation confirms that of Doane, who calls attention to the high leucocyte count of the milk of healthy cows.

A series of determinations was made with the Doane-Buckley method, on samples of the milk of individual healthy cows. In each deter-

mination two counts were made with different portions of the stained sediment. The results of these counts, together with figures indicating the percentage relation of the lower to higher, appear in Table 5.

TABLE 5.—*Numerical Determinations of Leucocytes by the Doane-Buckley Method, in which Two Counts were made from Each Centrifuge Tube.*

Number.	Leucocytes per c.c.		Per Cent Relation of Lower to Higher.	Number.	Leucocytes per c.c.		Per Cent Relation of Lower to Higher.
	First Count.	Second Count.			First Count.	Second Count.	
1	131,000	176,000	77.43	46	10,000	5,000	50.00
2	27,000	25,000	92.59	47	16,000	17,000	94.11
3	17,000	13,000	76.47	48	63,000	62,000	98.41
4	Clumped	Clumped		49	106,000	112,000	89.35
5	18,000	17,000	94.45	50	17,000	10,000	58.82
6	14,000	12,000	85.71	51	61,000	55,000	90.17
7	30,000	38,000	78.95	52	22,000	18,000	81.82
8	68,000	81,000	83.85	53	131,000	127,000	96.95
9	16,000	14,000	87.50	54	77,000	89,000	86.51
10	60,000	32,000	53.33	55	12,000	17,000	70.59
11	18,000	13,000	72.22	56	124,000	114,000	91.93
12	9,000	11,000	81.82	57	7,000	9,000	77.78
13	29,000	34,000	85.3	58	8,000	7,000	87.5
14	63,000	85,000	74.12	59	28,000	25,000	89.29
15	69,000	68,000	68.55	60	24,000	29,000	82.76
16	29,000	28,000	96.56	61	36,000	43,000	83.72
17	28,000	17,000	60.71	62	58,000	53,000	91.38
18	34,000	20,000	58.83	63	104,000	107,000	97.19
19	21,000	15,000	71.43	64	44,000	37,000	84.09
20	14,000	14,000	100.00	65	17,000	15,000	88.24
21	33,000	43,000	76.75	66	13,000	15,000	86.66
22	58,000	50,000	86.21	67	8,000	7,000	87.5
23	18,000	25,000	72.00	68	17,000	14,000	82.35
24	35,000	33,000	94.29	69	30,000	32,000	93.74
25	19,000	20,000	95.00	70	80,000	87,000	91.96
26	73,000	75,000	97.34	71	21,000	21,000	100.00
27	107,000	99,000	92.52	72	375,000	369,000	98.38
28	120,000	102,000	85.00	73	52,000	64,000	81.25
29	62,000	60,000	96.78	74	4,000	6,000	66.66
30	59,000	31,000	52.54	75	24,000	28,000	85.71
31	19,000	22,000	86.36	76	31,000	24,000	77.41
32	23,000	23,000	100.00	77	35,000	41,000	85.37
33	71,000	72,000	98.61	78	28,000	21,000	75.00
34	10,000	8,000	80.00	79	87,000	84,000	97.71
35	54,000	53,000	98.15	80	49,000	29,000	59.19
36	8,000	10,000	80.00	81	49,000	33,000	67.35
37	28,000	19,000	67.86	82	39,000	42,000	92.86
38	24,000	20,000	83.33	83	40,000	44,000	90.91
39	12,000	15,000	80.00	84	99,000	86,000	86.86
40	18,000	27,000	66.00	85	3,000	2,000	66.66
41	23,000	29,000	79.31	86	7,000	6,000	85.71
42	35,000	28,000	80.00	87	19,000	13,000	68.42
43	226,000	210,000	92.92				
44	581,000	445,000	76.60	Totals	4,314,000	4,274,000	
45	17,000	21,000	80.96	Averages	49,586	49,126	

The average for the first count is 49,586, and for the second 49,126, which is an agreement within one per cent. The agreement between each pair of determinations is fair. Twenty-seven agree within 10 per cent, and there are no glaring inconsistencies.

A series of determinations was made from market milk to determine the numbers found by the Doane-Buckley method. These are set forth in Table 6.

TABLE 6.—*A Series of Numerical Determinations of Leucocytes by the Doane-Buckley Method.*

103,000	116,000	49,000	90,000	50,000	8,000	90,000
183,000	72,000	147,000	137,000	15,000	29,000	52,000
71,000	56,000	135,000	32,000	44,000	46,000	147,000
37,000	23,000	251,000	104,000	40,000	99,000	108,000
56,000	63,000	146,000	203,000	102,000	85,000	49,000
69,000	305,000	56,000	140,000	99,000	23,000	182,000
85,000	178,000	147,000	36,000	44,000	20,000	159,000
101,000	81,000	26,000	50,000	97,000	14,000	147,000
139,000	235,000	17,000	68,000	65,000	235,000	178,000
30,000	123,000	202,000	73,000	105,000	202,000	52,000
147,000	9,000	52,000	83,000	78,000	116,000	32,000
10,000	116,000	72,000	350,000	51,000	81,000	68,000
53,000	164,000	14,000	144,000	52,000	123,000	61,000
48,000	159,000	32,000	197,000	7,000	49,000	13,000
43,000	189,000	207,000	113,000	5,000	42,000	49,000
17,000	40,000	68,000	54,000	40,000	40,000	37,000
71,000	32,000					

The average number of leucocytes per cubic centimeter of the 114 determinations is 90,614. Seventy-three numerical results are below 100,000, thirty-two between 100,000 and 200,000, seven between 200,000 and 300,000, and two above 300,000.

It would not be justifiable to regard even the highest of these as evidence of disease among the cows, for they have been equaled by counts from undoubtedly healthy cows. Doane (*loc. cit.*) presents a series of 102 counts of milk of healthy cows that average 241,000 per cubic centimeter. In not one of the 114 samples was any clumping observed.

The collection of the samples of milk used for the determinations appearing in Table 5 occupied three afternoons. The milk of nine cows was sampled and counted twice on these days. Table 7 contains the results of these counts, in each of which two drops were counted in the blood-counter. In some cases the interval between counts is one day, in others two days.

TABLE 7.—*Numerical Determinations of Leucocytes in the Milk of Individual Cows on Different Days.*

First Day.		Second Day.	
First Count.	Second Count.	First Count.	Second Count.
131,000	176,000	581,000	445,000
21,000	21,000	28,000	25,000
35,000	28,000	27,000	25,000
16,000	14,000	28,000	19,000
9,000	11,000	61,000	55,000
30,000	38,000	58,000	53,000
18,000	13,000	22,000	18,000
18,000	25,000	7,000	9,000
14,000	12,000	62,000	60,000
Totals -----	295,000	Totals -----	874,000
Averages	32,777	Averages	97,111
	37,888		78,777

The few observations recorded in Table 7 do not indicate a constancy in the number of leucocytes present on different days. The average of the counts of the second day is two and a half times the average of the first day.

The study of the leucocyte counts of the milk of a few cows over a long period of time would be an interesting piece of work.

TABLE 8.—*Counts, by the Doane-Buckley Method, of the Leucocytes in Samples of Mixed Milk from Dairies, and from Individual Cows in those Dairies—Continued.*

DAIRY 21.

Composite.....	46,000.	
Cow 1	1,110,000.	One quarter indurated. Used.

DAIRY 22.

Composite 1	134,000.	(?)
Composite 2	163,000.	(?)
Composite 3	245,000.	(?)
Cow 1	61,000.	Emaciated. Used.
Cow 2	115,000.	Emaciated. Used.
Cow 3	Clumped.	Abscess in udder. Used.
Cow 4	9,000.	Emaciated. Used.

DAIRY 23.

Composite 1	75,000.	
Composite 2	80,000.	
Cow 1	10,000.	(?) Used.
Cow 2	361,000.	Udder indurated. Used.
Cow 3	125,000.	Udder indurated. Used.
Cow 4	226,000.	Fresh. Not used.
Cow 5	152,000.	(?)

DAIRY 24.

Composite 1	180,000.	
Composite 2	43,000.	
Composite 3	62,000.	
Composite 4	20,000.	
Composite 5	104,000.	(Clumped).
Cow 1	190,000.	Abscess in udder. Used.
Cow 2	10,000.	(?) Used.
Cow 3	154,000.	Emaciated. Used.
Cow 4	268,000.	Fresh. Used.

DAIRY 25.

Composite 1	50,000.	
Composite 2	55,000.	
Composite 3	43,000.	
Composite 4	17,000.	
Cow 1	52,000.	Udder indurated. Used.
Cow 2	325,000.	Udder indurated. Used.

DAIRY 26.

Composite 1	25,000.	
Composite 2	25,000.	
Composite 3	14,000.	
Cow 1	196,000.	Emaciated. Used.

DAIRY 27.

Composite	47,000.	
Cow 1	959,000.	Udder swollen. Used.
Cow 2	207,000.	(?) Used.
Cow 3	67,000.	(?) Used.

DAIRY 28.

Composite	79,000.	
Cow 1	241,000.	Udder indurated. Used.

DAIRY 29.

Composite	21,000.	
Cow 1	383,000.	Emaciated. Used.

DAIRY 30.

Composite 1	17,000.	
Composite 2	16,000.	
Cow 1	20,000.	Udder indurated; fresh. Not used.
Cow 2	93,000.	Emaciated. Used.
Cow 3	54,000.	Emaciated. Used.

DAIRY 31.

Cow 1	453,000.	Fresh. Used.
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DAIRY 32.

Cow 1	17,000.	Fresh.
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It is noticeable in the table that the milk from the diseased cows has no recognizable effect on the count of the mixed milk. Most of the composite counts would be regarded as entirely normal, and the highest one of all is that of Dairy 9, 191,000, which lies well within the probable safety limit suggested by Doane.

In Dairy 3, cow 1 has a count of 4,800,000, and yet the mixed milk count is only 19,000. In Dairy 8 the mixed milk count is larger than that of any of the recognized diseased cows in the herd. The originators of the Doane-Buckley method of estimating leucocytes in milk did not claim that the milk of diseased cows could be detected in herd milk by an increase in number of leucocytes alone, but suggested that it might be recognized by an increase in number of leucocytes, together with clumping of the leucocytes or fibrin. Only six of the samples from diseased cows showed any clumping, and only one of the composites, that one being that of Dairy 24, in which none of the milks from diseased cows showed any clumping. The counts of the individual cows, all diseased, vary from 3,000, for a cow reported as having an udder abscess, to 4,800,000, for one reported as having an indurated udder.

CONCLUSION.

The results so far obtained confirm the suspicion that it is not possible to detect udder disease in cows by the examination of a mixed milk for number of leucocytes alone. The results by the Stewart method are so erratic that while an occasional count, which would be regarded as high for that method, may indicate trouble, the low counts seem to indicate only the failure of the method to show the leucocytes present. If the results by the Stewart method were consistent, all counts might be significant in spite of the fact that they show only a small proportion of the leucocytes present. We have no observations to show that a combination of large numbers of leucocytes and streptococci may not indicate that the milk is contaminated. We have encountered this condition very rarely and much less often than the condition of the herds would lead us to expect.

We do not regard the circumstance of finding diseased udders in a herd whose milk has been condemned by the Stewart test as a confirmation of the value of that test in locating udder diseases.

In the first place, udder trouble can usually be found in a large dairy. In an inspection of 9,200 cows in 86 dairies about San Francisco, made under the direction of one of us, 31 per cent of the dairies were reported as showing cows with udder disease. The inspection of dairy cows on a wholesale scale, with reference to the existence of udder disease, undoubtedly does not reveal the whole amount of such disease. The matter of udder disease was a small detail in the inspection of most of the 86 dairies, for the inspectors were primarily studying sanitary conditions.

The presence of streptococci in milk can not be regarded as proof of the existence of active mammitis in the cow. Reed and Ward¹ have observed the constant presence of streptococci in the milk of a healthy cow in the Cornell University dairy. The fact that she had not, so far

¹ Reed and Ward. The significance of the presence of streptococci in market milk. American Medicine, Vol. VII, p. 256.

as known, shown symptoms of the disease, lent special interest to observation. The milk record of the cow showed a steady increase from 1892 until 1898, when the observation was made, which fact indicates that she had not suffered a serious attack of mammitis. Berg (loc. cit.) found streptococci in samples of milk of cows in which inflammation of the udder could be discovered. Heinemann⁸ has made examinations "finding that streptococci are invariably present even in milk obtained with unusual precautions and from healthy cows." He reaches the conclusion: "Since *Streptococcus lacticus* is invariably present in market milk and in milk collected with good precautions, the sanitary significance of streptococci in market milk will need further investigation." Savage (loc. cit.) found streptococci present in 42.5 per cent of the samples of milk of individual cows, and found them in the mixed milk invariably.

The microscopic examination of milk for staphylococci is likewise of questionable value. There are plenty of micrococci almost invariably present in milk, that have the microscopic appearance of pyogenic organisms and even simulate them in cultural characteristics. The udders of healthy cows contain these micrococci and other organisms. Observations on the bacterial flora of the udder have been recorded by Bergey (loc. cit.), Ward⁹, Harrison¹⁰, Freudenreich¹¹, and others. The presence, then, of bacteria in even freshly drawn milk is no justification for the assumption that the organisms in question are pathogenic.

The Doane-Buckley test is far more consistent in every respect than that of Stewart. Examination of the milk of individual healthy cows by the Doane-Buckley method has shown such large numbers of leucocytes present in the milk of healthy cows that a narrow margin exists between the leucocyte count of the milk of healthy and of diseased cows. A distinction might be made in the examination of milk of individual cows, but when the milk of one diseased cow is diluted with others with a lower count, as in the case of a mixed herd milk, the result upon the average is impossible to detect.

In view of all these observations we feel that the numerical determination of leucocytes in mixed milk, for the purpose of detecting the existence of mammitis among the cows of the dairy, does not rest upon a firm experimental basis.

⁸ Heinemann. The significance of streptococci in milk. Journal of Infectious Diseases, Vol. III, No. 2, p. 173.

⁹ Ward. The invasion of the udder by bacteria. Bulletin 178, Cornell University Agricultural Experiment Station.

¹⁰ Harrison. The bacterial contamination of milk, and its control. Transactions of the Canadian Institute, Vol. VII, 1902-3, p. 467.

¹¹ Freudenreich. Ueber das Vorkommen von Bakterien im Kuheuter. Centralblatt f. Bakteriologie, II Abteilung, X Band, 1903, s. 401. Also, Ueber die Bakterien im Kuheuter und ihre Verteilung in den Verschiedenen Partien des Melkens Landwirtschaftlichen Jahrbuch der Schweiz, 1904.

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